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GULICK HYGIENE SERIES

TOWN AND CITY

BY FRANCES GULICK JEWETT

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THE GULICK HYGIENE SERIES

BY

LUTHER HALSEY GULICK, M.D.

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THE GULICK HYGIENE SERIES

BOOK THREE

TOWN AND CITY

BY

FRANCES GULICK JEWETT

GINN & COMPANY
BOSTON · NEW YORK · CHICAGO · LONDON

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INTRODUCTION

While the laws of personal hygiene are recognized on every side and even taught to children, the wider laws of community hygiene have not, in the past, been included in the curriculum of our public schools. This might seem strange save for the fact that the entire subject of public health is modern.

Indeed, with the power of the microbe unsuspected until 1865, with tubercle bacilli and the laws which control them undiscovered until 1882, with universal ignorance of the cure of diphtheria until 1892, and of malaria and yellow fever until 1901, it is not surprising that scientific facts about these preventable diseases have not as yet, to any appreciable extent, been adapted to the understanding of young children.

At last, however, between the progress of scientific research on the one hand and of unprecedented acquaintance with city conditions on the other, instruction in the importance of the laws of civic hygiene has become not only possible but imperative.

Scientists have learned not merely the causes of a high death rate but the way to avoid them. Moreover, the modern methods of research are of such profound

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interest that I can discover no reason why they should not be presented to school children with the sure expectation of enlisting their enthusiastic coöperation in the work of raising the standards of city life.

In planning this hygiene series I have had in mind the fact that children are influenced not so much by dogmatic assertion as by acquaintance with facts and courses of reasoning. Assure a child that unwashed people, crowded into unclean rooms, breathing impure air, and drinking impure water are more likely to be ill than clean people in clean rooms, breathing pure air, and drinking pure water, and he may or may not believe you; but explain to him the nature of those microbes which endanger life through water, air, and food; show by actual facts how the death rate has been raised and lowered; demonstrate by individual example the laws of contagion, and we shall convince the child by the same facts that have convinced his elders.

The capacity to profit by generalized statements comes only with age. For this reason, in the present series, even on the subjects of alcohol and narcotics, dogmatic assertion and the easy moral have been avoided. Treatment of subjects by this method necessarily increases the volume of the text, but it also rouses and holds the interest of the reader.

Although I have thus planned the series myself, the writing of each separate volume has been done by others.

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It is but just to these authors to say that in preparing the facts for presentation they have spared no pains to acquaint themselves with the work of the original investigators on whose authority their own statements rest. In proof of this is the present volume in which pure water is discussed. The author visited the experiment station in Lawrence, Massachusetts, where more scientific work has been done in sewage filtration than elsewhere in the United States, made careful study of water conditions in New York and other American cities, and consulted, among other works, the list of books contained in the bibliography at the close of this volume. Other subjects are treated with similar thoroughness.

Owing to the direct style and swift movement of each chapter, the vast amount of work involved is not recognized at once by the casual reader, but other readers will recognize the fact that nothing of this sort has ever before been done for children. In certain directions, indeed, the present volume represents a new step in the evolution of young citizens.

During the past few years important contributions have been made to the fund of information concerning the effects of the use of alcohol and narcotics. These contributions come partly from scientific work in Germany and elsewhere, partly from recent investigations of the interrelations of drink with crime and pauperism,

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and partly from the anti-alcohol requirements of large business corporations in the United States.

These facts, thus contributed, together with those more generally known, furnish a story of such exceptional vividness and power that, in regard to scientific instruction on the subjects of alcohol and narcotics, we cannot but be faithful to the demands of school law in the various states.

LUTHER HALSEY GULICK

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TOWN AND CITY

CHAPTER I

GROWTH OF CITIES

An Indian in his wigwam on the prairie may have quite as kind a heart as a city man in his city home; he may also be more vigorous and able to run faster, but as a rule he cannot in a single day do so much as the city man, either for himself or for his neighbor.

Just here, then, is the secret of our growing towns and cities. Human beings are becoming more and more anxious to give and receive all they can from day to day; and they wish to do this as conveniently and promptly as possible.

It turns out also that the more they have the more they want, and the more they want the more they learn to make, until to-day men and women all over the world are living together as groups of people who depend on one another. Some are manufacturing goods, some are selling them; some supply food, others supply wits. All are buying something, and in one way or another they all serve each other.

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Indeed, that is the one great advantage of our cities: people are close enough together to help each other at the shortest notice and in the best way. As time goes on, however, notice what happens. See how it has worked on Manhattan Island, where New York City stands.

HOMES ON THE PRAIRIE

In 1700 the houses of the city were far apart; wide streets were between them, large grounds around them, where children played; grass was everywhere, also trees, birds, and flowers. One hundred years later many more houses stood on the same space of ground; less grass was near them, fewer trees, no birds, hardly any flowers. One hundred years later still in certain parts of the city no grass could be seen as far as the eye could reach;

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no trees, no birds, only a few flowers in flowerpots, while the houses were so tall that the narrow, paved streets between them looked like hard, slender valleys between stone and brick mountains. Little chance for sunlight there! Instead of carriages drawn by horses,

A Village Home

there now appeared cars, automobiles, bicycles, and business wagons; and these rushed so fast here and there that children had to give up playing on the streets.

This was bad enough; yet into that crowded place people were now pouring at the rate of one hundred thousand every year; and, strange to say, they all found room to live. How did they do it?

Land was growing more valuable each year, and to make the most of it men ran their buildings up from three to seven and eight stories: one tenement in New

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York City is twelve stories high. They packed these houses so close together that, in some cases, almost no land in each block was left for a breathing space. They divided and subdivided each broad flat into scores and hundreds of tiny rooms; for, from first to last, the one object in mind was to make as many rooms as possible, so as to accommodate as many people as possible and receive rent from them all.

The result was that in 1897 five blocks of buildings in New York City held about three thousand people each; and by 1904 there were over three hundred and fifty thousand dark, unventilated rooms in the city. (Do not try to remember these figures, but notice how large they are.)

In 1900 one such block held twenty-seven hundred and eighty-one men, women, and children who were stowed away in fifteen hundred and eighty-eight rooms. As it happened, over four hundred of these rooms had no windows whatever and no outside doors, while six hundred other rooms opened into the air shafts. Now an air shaft is often simply a twenty-eight-inch wide air well that runs up through the center of the building. Anywhere from twenty to sixty windows open into it, and wretched odors from scores of kitchens and bedrooms stream into it so constantly that people often nail up their own windows to keep out the smells and the polluted air from other rooms.

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Taken altogether, then, in a single block there were over one thousand rooms which no ray of sunlight could ever find, which no breath of really fresh air could ever enter. In fact, when the doors of most of those rooms were shut, they were like black, airless boxes with the

HOMES IN NEW YORK CITY

covers on. Nevertheless, in 1900, in that very block, four hundred and sixty-six babies were trying to keep alive. No wonder they often failed! No wonder they died even faster than the grown folks!

Still, by running up those towering houses, by making many rooms, by crowding human beings into them

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regardless of life and health, New York City manages to accommodate hundreds and thousands of fresh arrivals every year. The end of it is that, in a certain district of the city, people have stowed themselves away at the rate of two hundred and ninety thousand to the square mile. This simply means that just there more human beings live closer together than they do anywhere else in the world.

Since that sort of crowding must be woefully uncomfortable, we wonder why yet other people are willing to increase the crowd by going to that particular spot to live.

The truth is that, as a rule, when a man goes to a city to carry on his work he cannot afford either to buy a house or to build one; still he must find a home for himself and his family somewhere, and for the sake of saving time and car fare he hires rooms as near his work as possible. Then, too, other men who are hunting for work go to the same region. They also hire rooms there; and at any point in a city where those two streams of people meet, there the houses are tallest, the streets narrowest, the rooms darkest.

Not only this, but multitudes of these men and women know nothing about the advantages of fresh air, cleanliness, and ventilation. They must also economize all they can. When, therefore, they have all they can do to buy food and clothes for the family, and when they find that

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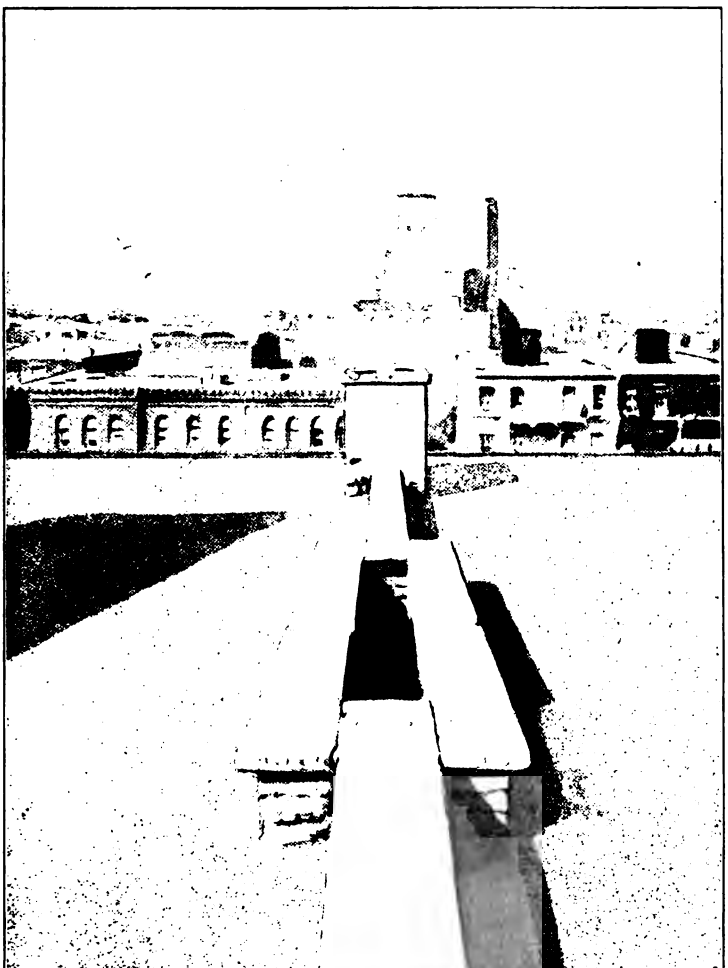

AN AIR SHAFT TWENTY INCHES WIDE AND SIX STORIES DEEP

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they can save four or five dollars a month on rent by living in dark, close sleeping rooms, they are almost sure to do it.

Generally the consequences of overcrowding are darkness, unclean houses, unclean air, and unclean people. Disease microbes are sure to follow; and wherever they go the history is the same, for disease and death travel with them.

On the other hand, in every city there are thousands of homes with room enough around them to give grass, flowers, and children a chance; and each home of that sort raises the health standard for the entire city. Wide, clean streets full of sunshine do the same thing; yet the most beautiful home in the most beautiful city is in danger when, in another part of the same city, narrow streets and crowded blocks are filled with men and women who live in the midst of uncleanness, impure air, and disease.

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CHAPTER II

RESULTS OF OVERCROWDING

No owner of tenement houses in a crowded city would for a moment think of walking through the streets with a revolver, shooting down thirty or forty persons out of every thousand whom he should meet, for the sake of robbing them. But he does something quite as bad when, knowing that his houses are death traps, he rents them to thousands of people, who live in them and die in them while he pockets the rent.

Mulberry Bend in New York City used to be one of these terrible places. In early days it was "a crooked three-acre lot with a path through it made by cows." But it ended by being covered close with rotten buildings, narrow stairways, halls so dark that a man could not see his hand before his face, and small unventilated rooms, where every year people died at the rate of forty or more for every thousand who lived in them.

In London the crowding is so great that three hundred thousand of its citizens live in tenements of one room for a family. Forty thousand of these live five in a single room, while eight thousand live eight in a room.

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When overcrowding reaches such a point everything suffers. Careless people using dark halls, cellars, and bath rooms are not neat in disposing of their rubbish, their garbage, and their soiled clothes. They act as if they thought the darkness were going to save them

MULBERRY BEND, A NOTORIOUS SLUM

from disease as well as from disgrace. Yet everything helps disease along in these neglected houses. Gas pipes leak and sewer pipes are out of order; the air grows heavy with carbon dioxid, with illuminating gas, with foul gases from broken sewers, with the smell of dirt; while at the same time dampness adds to the dangerous conditions.

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Mr. Riis, who has studied New York City thoroughly, was in despair when he saw the condition of things. He found cellars so near the river that the water soaked through and rose and fell with the tide. Indeed, he says

A DARK, INTERIOR ROOM

There are over three hundred and sixty thousand like it in New York City

he knew cases where parents "kept their children in bed till ebb tide" to keep them dry.

Fifty years ago in Boston the situation seems to have been even more tragic; for during a cholera epidemic, when a certain doctor went to see a sick woman who lived in a cellar, he found the water so deep that the only way he could reach her bed was by walking on planks laid from one stool to another.

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In those days, of course, no one knew that dampness, darkness, and dirt are just the three conditions that are best for microbes and worst for men; to-day those facts are plain enough. It is also quite as plain that even when a city is clean, well built, and uncrowded, the inhabitants of the place may die each year at the rate of seventeen for every thousand. Men know this from records that have been kept; they are, therefore, startled over other city records which show that when people live in damp, dark cellars, or in dark, crowded, unclean houses, the number of deaths jumps to thirty or forty for each thousand.

RUBBISH IN THE COURTYARD

In New York City the darkest and most unwholesome houses are rear tenements which stand so close behind the front tenements that the distance between them is from two inches to five feet. Of course, each building keeps daylight from the other; at the same time the rear tenement is always the older, the more unclean, and the more neglected of the two. Naturally,

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of course, the rents are lower here and the people more crowded.

Remember these facts and read the following figures. Mr. De Forest, in his book called *The Tenement House Problem*, tells us that, in the First Ward, in tenements which had no houses behind them, about twenty-nine people died out of each thousand that lived there; whereas, in the same ward, when there was a rear tenement, the deaths rose to sixty-one for each thousand of the occupants. Sadder yet, in such places, when an epidemic once had a start, nothing stopped it,— young and old, strong and weak, all seemed doomed.

WHERE MICROBES LIVE TWO YEARS AND LONGER

This is bad enough for grown folks, but babies always suffer most in such places. In those rear tenements, therefore, the death rate for babies rose to two hundred and four for every thousand; that is, one baby died for every five that were born. When men began to realize all this, they called

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those places " infant slaughter houses," for they said that the condition of the buildings killed the babies.

In Berlin, Germany, in 1885, there were over thirteen hundred thousand residents, and seventy-three thousand of them lived in families in one-room tenements. That means that each family lived, slept, cooked, and ate in the same room. They were distributed as follows:

In one-room tenements	73,000
In two-room tenements	382,000
In three-room tenements	432,000
In four-room tenements	398,000

Now compare those figures with this other table which shows the death rate in each set of rooms:

	Per Thousand
In one-room tenements	163.5
In two-room tenements	22.5
In three-room tenements	7.5
In four-room tenements	5.4

These astounding figures showed that families in four-room tenements were thirty times as likely to live through the year as those in one-room tenements. The explanation is the old one that we began to understand in *Good Health.* Any human being who has too little oxygen or too little sunshine, who breathes air with gas in it, or odors from soiled clothes, from leaking sewer pipes, from decaying food and unwashed people, is doing what he can to make his body too weak to resist disease

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microbes. In the end, therefore, he may be as helpless before them as a half-starved man is helpless before a wild animal, — the animal and the microbe are likely to be victorious in both cases.

This is serious enough, though it is not the whole of the story, for all thinkers know that the place a man lives in affects his character; that the more crowded, unclean, and uncomfortable a tenement is, the more lawless and reckless do the inhabitants become; that jails, hospitals, and asylums are filled with streams of unfortunate citizens who pour into them from the more unhealthful tenements.

In fact it is true that every year forty thousand men and women find their way from the same part of New York to the penitentiaries and the almshouses of the city.

There are two reasons, then, why every part of a city should be kept in healthful condition:

1. Because cities need men and women with strong bodies.

2. Because cities need men and women with strong characters.

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CHAPTER III

REFORMS

In 1902 New York City established a new Tenement House Department, and after that reforms moved along at a brisk pace.

Four hundred inspectors were then chosen and sent out to visit the eighty-two thousand tenements of the city and to report on the condition of these buildings, which held twenty-three hundred thousand people. The precise definition of a tenement is a house in which three or more families live and keep house separately, or where more than two families live on one floor.

For the first time in the history of New York her tenements were being thoroughly examined. Sometimes the tenants were curious over the work of the inspectors; at other times they were indignant; but they always ended by being grateful.

One of the first inspectors visited a five-story house on the East Side; and crowds of Italian men, women, and children gathered around him, curiously wondering what he wanted. They were astonished to have him go directly to the cellar. He himself was astonished two minutes later when he stepped off the lowest stair into

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a pond of cold water. The children giggled, of course; but he lighted a torch and looked around. Such a sight! Baskets and boxes and trash of every sort were afloat. Indeed, as he said afterwards, it looked as if a ship had been wrecked down there. Everybody was ready to help, however, and with chairs, stones, and planks he made a bridge across to the waste pipe. There he found the trouble, — a hole three inches wide and six inches long, with all the waste water of the entire house pouring through it into the cellar.

With such an introduction to the house as that, he was prepared for anything else, — water pipes and flushing apparatus out of order; woodwork around the sinks so rotten that the odor of the place was intolerable; walls, ceilings, and floors unclean beyond description.

After this report was sent in reformation began. Carpenters, plasterers, and plumbers went to work; pipes were mended, flushing basins put in order, ceilings renewed, walls whitened. And when the inspector visited the place again a few weeks later he says he should not have known it except for the Italians. But they knew him at once and proudly took him around from one part of the house to another to show off the wonderful improvements, — new drain, dry cellar, new washtubs, clean walls, fresh ceilings, all as tidy and wholesome as possible.

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That was the experience of one man. Reports also went in by the hundred and the thousand from all the other inspectors, until the department at last felt that they had pretty definite knowledge to go by. They then decided to do three things:

1. To give the city the right kind of new tenement houses.

2. To continue with the work of making the old ones fit to live in.

3. To supervise both the old and the new so carefully and constantly that they would be kept in sanitary condition.

Many owners of tenements resisted these improvements, saying that they could not afford to pay for them, but the officers of the department were firm; the law was behind them and they enforced it. Hundreds of the worst tenements were bought by the city and pulled down; others were repaired and altered; while, as fast as possible, new tenements were built. And now came a pleasant surprise. In many cases the owners themselves began to be grateful; for they found that instead of objecting to higher rent, thousands of citizens were willing to pay a little extra for the sake of clean rooms, pure air, and more sunshine. In fact they often seemed enthusiastic about these things.

Still the greatest enthusiasm was over the new tenement houses themselves. During 1902 five hundred and

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forty-three of these were put up, and in 1903 there were over twice as many more. They were such an improvement over the old buildings and people were so anxious to live in them that they were rented not only as fast as they were finished, but every room was engaged even before the buildings were fairly up. Sometimes people even went so far in their eagerness that they rented their new homes from the drawings of them, which they examined before the first stone of the building was laid.

More than that, in certain parts of the city there was such great interest in the matter that troops of men and women took their friends with them on Sunday excursions to visit the new tenements. They enjoyed the light rooms, bathrooms, wide halls, fresh air, and sunshine. Rents were a little higher to be sure, but everything was built according to the new law; and since that time people have talked about "new-law houses," which means houses built since 1901, and "old-law houses," built before 1901. Notice the difference between the two sets:

Old-law houses. Hundreds of small rooms with no outside door or window; no chance for light; no fresh air in the building except through the slamming front door; halls narrow, sixty feet long, so dark that you stumbled over ragged creeping babies without seeing them; stairs narrow, steep, dark; cellars damp, neglected, often filthy; bathrooms in common for the entire building; very little protection against fire; central air

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shaft twenty-eight inches wide; dust, dirt, rubbish, and darkness everywhere. Yet the rent for these dreadful places was often very high.

New-law houses. No room without a window opening out of doors; good light and ventilation; halls square, broad, light; stairs neither steep nor dark; every one of them fireproof; cellars damp proof; separate bathroom arrangements for each family; courtyard not less than twelve and a half feet wide and twenty-eight feet long; light everywhere so that dust and rubbish show plainly and have little chance. These new dwellings were often built by honest people who were not willing to charge too much for rent.

No wonder those buildings were besieged by people who wished to live in them.

Yet even in making old tenements respectable the department did great things. Here are a few figures to show what the reformers accomplished in eighteen months. They found the names of forty-four thousand tenement-house owners and saw to it that they repaired their property according to law. They cleared out eleven thousand cellars and halls full of rubbish and filth; cleaned thirteen thousand ceilings and fifteen thousand walls; put down ten thousand new floors and placed seventeen hundred fire escapes. It is not necessary to remember these figures; simply notice what a great work was done in a short time.

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As this was going on tenants were encouraged to complain to the department about owners who were not keeping their houses up to the standard of the law. Twenty-five thousand of these complaints came and were looked into. Some of them were certainly not very reasonable; for Mr. De Forest, from whose report I take many of these facts, says that one old lady was indignant because the department did not clear the fleas out of her room, while another wanted somebody to stop the janitor from raising dust when he swept, — a most important point, yet the department could not take charge of such details.

With so much being done, New York was cleaner and in better health in 1903 than ever before. As Mr. Riis says, she had made fifty years' progress in four years; and the one great fact that proved this was the change in her death rate. I give a table covering several years to show the gain:

	Deaths per Thousand
1866	33.00
1887	26.00
1897	20.03
1901	20.00
1902	18.70
1903	18.11

If the population of New York City is four million, as it soon will be, a small change in the death rate makes a large change in the whole number of those who die.

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Indeed, in this case, even the figures at the right of the decimal point become an important matter. Let one additional life be saved for every thousand people every year, and enough will be kept alive to fill a good-sized village. Notice the following figures carefully:

4,000,000	dying	at	rate	of	26	per	1000	a year = 104,000
"	"	"	"		20	"	"	" = 80,000
"	"	"	"		18	"	"	" = 72,000
"	"	"	"		17	"	"	" = 68,000

In New York City, therefore, if the death rate should be seventeen instead of eighteen out of every thousand, four thousand lives would be saved in one year. This is worth striving for.

In tenement-house improvement Boston has worked as well as New York. Indeed, since 1890 there have been citizens' movements in Chicago, Philadelphia, Cleveland, Washington, Baltimore, St. Louis, Cincinnati, Kansas City, and thousands of smaller places. Cities take lessons from each other, and the larger the city the larger the lesson. For this reason New York City is the best place to study overcrowding and reforms, for no city in the United States can compare with New York in size and in improvement of tenement houses.

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CHAPTER IV

EXPENSE OF ALCOHOL TO STATE AND CITY

When reforms are such an expense to a city, it is well for the citizens to know what other expenses must be met, and to decide whether money is being wasted in any way. We learn something about this from the state of Massachusetts, for this state leads the country in the way she has studied the expense of crime to both the city and the state.

In 1880 a certain committee of men proposed to find out the exact connection between crime and alcohol, and to do it they kept track of the work done by nine criminal courts in Suffolk County. These remarkable figures show what they discovered:

Sentences for drink	12,221
Sentences for illegal selling	68
Sentences for other crimes	4,610
Total sentences in Suffolk County for one year	16,899

Notice the difference,—twelve thousand alcohol arrests and four thousand arrests for all the other crimes put together! Such was the record for one year. But it seems that, for twenty previous years, the same sort of statistics

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had been kept. They show that during that time sixty sentences out of every hundred in the whole state of Massachusetts were for what are called "liquor offenses."

Matters did not improve fast after that, for in 1895 the same committee studied again, and found that during the year sixty-six sentences out of every hundred in the state were for actual drunkenness. Besides, there were thousands of cases where men were under the influence of alcohol when they planned or committed their crime. With these included, the committee found that for a single year eighty-six out of every hundred who were sentenced could point to alcohol as the cause of their disgrace.

This is bad enough, but it is not all. Think of the "Animals and Alcohol" chapters in *Good Health* (Grade 4), and remember how it turned out with the unfortunate pups of those unfortunate dogs. As for human beings, the case seems to be worse yet.

Elmira, New York, has a large reformatory for convicts, who come from all parts of the state. They often live to be honest law-abiding citizens afterwards; but there is this remarkable fact about them, which was shown in 1900. During that year there were 9344 convicts in the reformatory, and of these 3363 had drunken ancestors, — a little more than one third! Clearly enough the state had to meet extra expense in carrying on the reformatory just because those ancestors who drank had given weak characters to their descendants.

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Of course no one can ever guess how much a state loses by inheriting weak citizens instead of strong ones, for the weak will always be a burden, while the strong help in every way. But the actual number of prisoners can be counted. Moreover, people know what it costs to arrest and try them; they also know how much it costs to keep them in jail and feed and clothe them. And when all these items are added together, it is not hard to decide what part of this expense belongs to alcohol. Then, too, there are the poorhouse bills that come through alcohol. Now the point to keep in mind is that all these bills are paid by the people of the state through their taxes.

The statistics of London show that the city pays five million dollars a year for the expense of its drunken paupers.

Mr. Henry M. Boies, who has studied the subject for years in America, says that the crime committed in the United States costs at the rate of $6.20 a year for each man, woman, and child in our country. He also says that alcohol's share in the expense of this crime is about $4.34 for each person. Drunkenness alone, he tells us, costs the United States four hundred and twenty million dollars a year.

Do not try to remember any of these large numbers, but be sure to remember that it is almost always other people who pay the drunkard's bills, and not the man

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himself. They pay them by supporting jails, reformatories, asylums, hospitals, and courthouses; for alcohol takes more people to these places than any other one thing, and while they are there very often the city has to take care of their families besides. No wonder thousands of people are asking whether it is worth while, — whether it would not be more sensible to get rid of crimes that come from alcohol, just as we get rid of tuberculosis and smallpox by getting rid of the thing that starts them.

Certain cities and states have tried an experiment. For a while they have allowed men to sell all the alcohol they wished in public places. Then again they have made such laws that it has been impossible for anybody to sell alcohol anywhere except in the sliest, most quiet fashion. Both ways were tried in Ireland years ago, Lord Morpeth was secretary of the country at the time, and these are his figures:

MURDERS, ATTEMPTS AT MURDERS, OFFENSES AGAINST THE PERSON, AGGRAVATED ASSAULTS, CUTTING, AND MAIMING

1837	12,096	1839	1097
1838	11,058	1840	173

In trying to explain the sudden change in the number of crimes, Lord Morpeth could think of but one reason, — the temperance work of Father Mathew. This good man was so much in earnest in fighting alcohol that thousands of other people became enthusiastic, too. The movement

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spread over the island like a wave of the ocean. It also swept things so clean that there were only twenty-three prisoners in Bridewell prison at Dublin instead of one hundred and thirty-six, while one hundred cells were empty; and the Smithfield prison had to go out of business because there was no one to be locked into it.

To come nearer home again, in 1873 Vineland, New Jersey, and New Britain, Connecticut, were towns of about the same number of inhabitants. In other ways, however, they were very different, as this table shows:

	Vineland	New Britain
Saloons		80
Cost of paupers	$224	$8,500
Cost of police	$75	$7,500
Cost of liquor sold		$319,000
Habitual drunkards	27	497

Evidently at that time any taxpayer in New Britain had to spend a good deal of his money for the prosperity of the alcohol business of the place. He had to do this even if he did no drinking himself; for he was taxed to support the paupers that alcohol made; also he had to help pay the salaries of the policemen, yet these policemen spent their time in taking care of people who drank alcohol and ruined the lives of their friends and neighbors.

On the other hand, Vineland had no such alcohol expenses, and her citizens were able to spend their money in pleasanter ways.

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The story of New Britain is the story of every city that allows alcohol to be sold publicly. And always the larger the place the larger are the bills which alcohol runs up for the industrious people of the city to settle.

Brockton, Massachusetts, learned this in 1898, when her population was about forty thousand. She had kept saloons out for eleven years, then voted to let them in again. The following figures tell the history:

	Arrests for Drunkenness	Assaults
No-saloon year (1897)	435	44
Saloon year (1898)	1627	77

This was such a lesson that the city promptly voted against saloons again, when we have:

1899

Arrests	455
Assaults	66

New York City has never tried the experiment of no saloons. Instead, here is her record:

NEW YORK CITY STATISTICS FOR 1904

Saloons	10,821
Arrests	133,749
Expense of Police Department	$10,199,206
Police courts, jails, workhouses, reformatories, etc.	$1,310,411
Hospitals, asylums, and other charities	$4,754,380

When we remember the difference between the no-liquor town of Vineland and the liquor town of New

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Britain, and when we also remember the Massachusetts report on crime and alcohol, we can imagine how the New York bills for poverty, crime, police, and jails would shrivel if alcohol were not sold by those ten thousand saloons in the city.

No good citizen grumbles over honest city bills for useful things. On the contrary, he is glad to be taxed for pure water and gas, for street cleaning, for schools and public buildings, for parks and the fire department; he wants his city to be beautiful and healthful. But he does feel inclined to grumble when he finds himself paying heavy taxes for the support of something which harms the city beyond measure. For, as we have seen already, those who use the most alcohol, those who fill the city with crime and the jails with criminals, are not apt to be those who pay the bills.

When you see a drunken man arrested, or read of men taken to jail or to the hospital because they have damaged themselves or other people by using alcohol, you might say to yourself: "My honest, hard-working father helps pay for arresting the man, for trying him, for taking care of him in prison, for feeding and clothing him while he is there; and if he dies in the place my father will help bury him." You might even whisper to yourself, "If my father didn't have to pay so much to help settle the disagreeable saloon bills of other people, he might have more money for himself and me."

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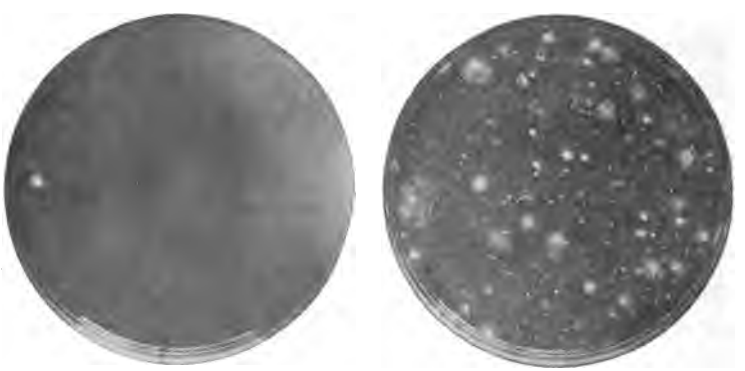
CHAPTER V

CLEAN STREETS IN NEW YORK

So far as health is concerned, the pictures show why clean street air is better than unclean street air for breathing.

Our eyes cannot always prove this, for sometimes one space of air looks quite as clear as another. Scientists,



FROM CLEAN STREET AIR FROM UNCLEAN STREET AIR

Each white spot shows a colony of microbes

however, have hit on a device for testing the case accurately. They cover glass plates with gelatin; catch on them samples of whatever floats in the air; let the microbes stay there and grow for a while; examine them

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with a microscope, and afterwards even photograph them for ordinary people to see.

The important discovery which they make from all this is that in certain parts of certain cities the street air is laden with microbes of every sort, and that disease microbes increase with the increase in other kinds.

More than that, they find that the nearer the ground the worse the air is, whereas the higher up they take the sample the purer it becomes. They therefore tell us that the taller the man the purer the air he breathes, and the shorter the child the more microbes has he in his air. Thus it turns out that the matter of clean streets is especially important for little people.

Then too, aside from the microbes, the appearance of the streets and the odors in them were enough to make New York decide to have a reformation in 1895; or perhaps it was Colonel Waring himself who decided on the reformation, for just at that time he was chosen head of the street-cleaning department of the city; and the result was a new era for New York. When he accepted the position things were in such bad shape that some of his friends told him he would be able to get nothing out of it but disgrace for himself, and that, for his own sake he would do well to resign and go back to his own home in Newport. But he was not the kind of man to run away from hard things; he simply made up his mind to conquer the situation.

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I suppose that no street in New York to-day is in the dreadful condition of those which he found on every side.

On Ludlow Street, [he says] from the corner of Stanton the street was very filthy. Trucks, wagons, and carts were standing in filth of every kind from one to two feet deep, and the street was covered with old paper, rags, ashes, garbage, straw, and general refuse. . . . On Sullivan Street, from Houston to Bleecker, barrels of ashes and garbage were in front of nearly every door; and along the side of the street piles of garbage, old rags, tins, oyster shells, old paper, and general refuse from two to four feet high, from which a bad stench arose.

So he describes street after street; and it seems that the narrower and more crowded they were the more dreadful was their condition. As the explanation of all this, Colonel Waring decided that the whole trouble came from mixing politics with street cleaning. He saw that from the highest overseer down to men who did the sweeping, each separate man received his position not only because he promised to vote in a particular way on election day, but also because he promised to get other men to vote as he did; that is, each man received his position as a reward for votes. The one important thing seemed to be that a man should vote as somebody wished him to, not that he should do the work he was paid to do.

As New York citizens were being taxed to pay for street cleaning, they did not fancy the notion of having their money go to pay for votes instead of clean streets, and

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Colonel Waring agreed with them. He therefore decided that the first thing to do was to separate street cleaning from politics. When he came to that decision his famous saying was that he would "put a man instead of a voter behind every broom."

This does not mean that men were to stop voting; it only means that voting was not to interfere with street cleaning. So long as a man worked well he was to keep his position no matter how he voted, and when he did not work well he was to go no matter whom he voted for.

A Street Sweeper and his Tools

With this arrangement lazy and careless workers were soon dropped, while all who were willing to do faithful work stayed.

Naturally enough, there was a wonderful change at once. The streets grew cleaner. Men who did the sweeping not only began to respect themselves, but they were more and more respected by everybody else; so much so that after a while the street-cleaning department of New York City was heard of throughout the United States and Europe, and everywhere it was spoken of with admiration.

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The sweepers themselves were called Colonel Waring's "White Wings" because their uniform was a loosely fitting uniform of white duck with a white helmet to match. The suit was generally changed Mondays and Thursdays, oftener if necessary, so that a street sweeper in New York always looked tidy and clean.

Colonel Waring had over sixteen hundred regular street sweepers, almost a thousand cart drivers, besides foremen, superintendents, and overseers; he also divided the city into definite sections, and each man knew exactly what part of a particular street he was to keep clean. As a rule each had charge of about one third of a mile, but on particularly crowded streets there were six or seven men to a mile. Here, too, each man had his own section, which he was to sweep as many times a day as was necessary to keep it clean. No sweeper was supposed to work over eight hours a day.

Before Colonel Waring took charge sweeping machines had been used; but he found that sweeping done by hand raises less dust and leaves cleaner streets; in New York City, therefore, almost all the sweeping is done in this way. It is only on rough cobblestone streets, like those in Brooklyn, that machines seem to be needed.

The newest and best street-cleaning work is done through hose flushing. By this method microbes are flooded out of the way instead of being stirred up with the dust and tossed about into the air for citizens to breathe.

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After Colonel Waring had been in charge several months it looked as if some magician had been at work in New York, for everywhere the streets were really clean; on rainy days there was little mud, and on dry days little dust. Of course careless people continued to scatter paper and rubbish about, but nothing stayed in sight long. In fact the change went even farther than

FLOODING OFF THE DUST AND MICROBES

that, for with clean streets the residents began to have cleaner front steps, cleaner hallways, and cleaner houses; they themselves were cleaner; and even in the worst part of the city they were more careful about tossing things into the street just to be rid of them.

Besides rubbish, snow is a great city nuisance; and any one who saw how New York treated the January blizzard of 1905 realized at once that clearing away a

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storm like that is a very different matter from the every-day business of keeping the streets clean.

The city was white and quiet and buried in snow; her surface cars were standing in silent rows; her business was arrested; and the question was how she was

GETTING RID OF CITY SNOW

ever going to pull herself out of the drifts and begin to move around again.

But she did it. The storm was on Wednesday, and by Friday night three hundred thousand cart loads of snow had been taken from the most important business streets and dumped into the river. To do this ten thousand men had worked in day and night relays; they had used shovels and picks and horses, with five thousand trucks to draw the loads away. The work kept on for

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days afterwards, and that one snowstorm cost the city about three hundred thousand dollars.

In every town and city there are two reasons why snow should be cleared away as soon as possible after it falls:

1. City business. It cannot go on briskly when people cannot travel about.

2. City health. If microbes and garbage collect in the snow, when melting time comes they are ready to thaw out and spread disease in the neighborhood. More than that, thousands of children take cold every winter because their feet have been in melting snow for hours, with no chance to dry.

Since no storm can be planned for in advance, and since extra street cleaners are needed as soon as the snow stops falling, the city lets this work out to contractors, who hire thousands of men, trucks, and truck drivers in advance of every storm, telling them to be ready to begin work at a moment's notice.

When the storm is over, therefore, a valiant snow army seems to spring from the ground, and each man finds his appointed street. Every sort of worker is there in every sort of costume, also trucks of many kinds, and the work is well done.

After all, however, the daily work of clearing the streets is even more important than getting rid of the snow. To-day New York is one of the clean cities of

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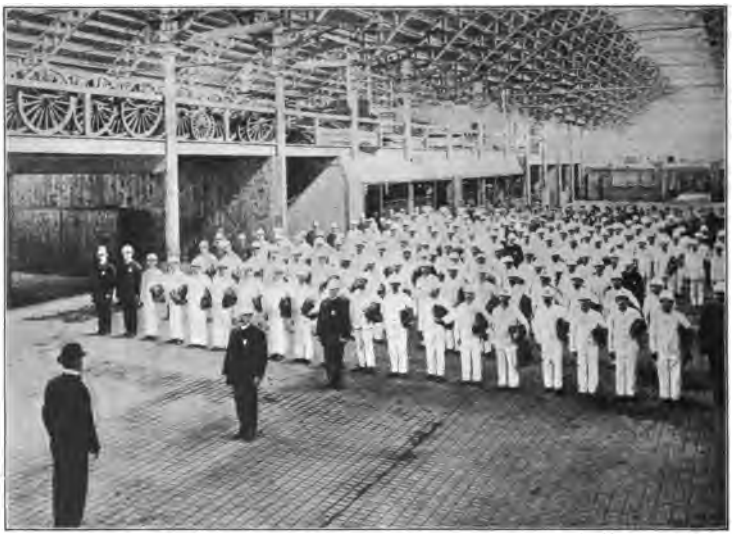
the world. Colonel Waring with his White Wings made the change between 1895 and 1898. They were a well-trained faithful brigade of street soldiers, and they transformed New York. They gave her clean pavements, clean feet, better air, and healthier children;



STREET SWEEPERS ON INSPECTION DAY

they set an example which has been followed ever since, for Dr. John McGaw Woodbury, with many more White Wings than Colonel Waring ever had, and many more miles of street to sweep, is keeping up the record which Colonel Waring made.

[1] In 1906 Greater New York employed 2455 sweepers who covered 1581 miles a day. Each day also 75 miles of street were washed by hose and flushing machines.

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CHAPTER VI

JUVENILE STREET-CLEANING LEAGUES

New York children took their part in the street-cleaning history of the city when Colonel Waring decided to start street-cleaning leagues.

In a general way these were really boys' clubs carried on somewhat like a parliament; for the boys got together, elected their own officers, and prepared a constitution. This stated that the object of the club was to "keep the streets in a clean and healthful condition." They had regular business meetings every week, and at their meetings they discussed all sorts of subjects connected with the health and cleanliness of the city.

Each club sent reports to Colonel Waring, telling him what had been done during the week in the way of keeping the streets clean, — picking up banana skins, orange peel, paper, etc. The members also kept their eyes open and reported whenever they saw that people from certain houses were sweeping rubbish into the streets, or breaking any other street regulation. Thousands of these reports were received, and they are safely stowed away in one of the stables of the street-cleaning department of the city.

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Some of them have mistakes in spelling, but they did such useful work that I must quote one or two from Colonel Waring's book, which gives the full history of these leagues:

COLONEL WARING,

Dear Sir; — While walking through Broome street Monday, at 7.30 P.M. I saw a man throwing a mattress on the street. I came over to him and asked him if he had no other place to put it but there. He told me that he does not know any other place. So I told him in a barrel, and then he picked it up and thanked me for the inflammation I gave him. I also picked up 35 banana skins, 43 water mellon shells, 2 bottles, three cans, and a mattress from Norfolk street.

METROPOLITAN LEAGUE

I saw a man eating a banana. He took the skin and threw it on the sidewalk. I said to him "please sir will you be so kind and pick it up," and he said "all right."

JUVENILE PROGRESS CLUB

To COL. WARING; — Distinguished a bonfire on 5th St. between Ave. C and D.

INDUSTRIAL LEAGUE

The officers gave heed to these reports, and law-breakers were either punished or cautioned. This did good promptly, and all sorts of people grew more interested and more intelligent on the subject every day. Then too the street-cleaning department gave badges of honor to those boys and girls who sent in reports which showed that they were really working for the interests of the city. The badges were made of German silver; they

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were eight sided, engraved and polished, and a certificate signed by Colonel Waring himself went with each badge. Some members of the league received the rank of "helpers"; others were "foremen" and others "superintendents"; they were always advanced according to their diligence.

Clubs now became so popular in the public schools that from one part of the city and another came committees of boys with the petition: "Please may we have a club?"

"Why do you want a club?" Colonel Waring asked one day.

"Oh," they said, "the boys on our block, they knock bananas, shells, and all dirty things in the street, and we want to reform them."

"But perhaps the boys are very bad and don't want to be reformed," he said.

"Oh, yes, they do," one of them answered. "We asked them, and they all said they did."

This account is quoted from Colonel Waring's book.

So the clubs were started one after another in 1896 and 1897. Public-school boys and girls were proud of their clean city, and they resolved to keep it clean. At the same time mass meetings were held in different places, where city officials talked and where the children sang street-cleaning songs. On the next page read one of them: it is long, but they sang it with enthusiasm.

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NEIGHBOR MINE

There are barrels in the hallways,
Neighbor mine;
Pray be mindful of them always,
Neighbor mine.
If you 're not devoid of feeling,
Quickly to those barrels stealing,
Throw in each banana peeling,
Neighbor mine!

Do not drop the fruit you're eating,
Neighbor mine,
On the sidewalks, sewer, or grating,
Neighbor mine.
But lest you and I should quarrel,
Listen to my little carol;
Go and toss it in the barrel,
Neighbor mine!

Look! whene'er you drop a paper,
Neighbor mine,
In the wind it cuts a caper,
Neighbor mine.
Down the street it madly courses,
And should fill you with remorses
When you see it scare the horses,
Neighbor mine!

Paper-cans were made for papers,
Neighbor mine;
Let 's not have this fact escape us,
Neighbor mine.

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And if you will lend a hand,
Soon our city dear shall stand
As the cleanest in the land,
Neighbor mine.

In all this the children felt that the city in which they lived was their city, and that they wanted to help make it the cleanest, most healthful city in the world. The clubs all used the same pledge, which I give:

CIVIC PLEDGE

We, who soon are to be citizens of New York, the largest city on the American continent, desire to have her possess a name which is above reproach. And we therefore agree to keep from littering her streets, and, as far as possible, to prevent others from doing the same, in order that our city may be as clean as she is great and as pure as she is free.

In 1896 there was a monstrous parade of the leagues. The girls rode on trucks with four horses to draw them; the boys marched, wearing their badges and their white caps, and grown-up citizens along the route cheered them on.

Perhaps some of those who cheered did not understand English, for we read that in various parts of the city street-cleaning league boys and girls had to translate the street regulations to their parents; yet this also was most useful service.

Indeed, the work which those children did on every hand was so important and successful, and they did it

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with such enthusiasm, that other cities heard about it. Men from Boston and Chicago then went to New York on purpose to see just what was being done and just how it was done, while young citizens in Philadelphia, Pittsburg, Utica, Denver, and other places started clubs of their own in imitation of New York.

The real object of each of these juvenile city leagues is to make it easy for boys to pull together in ways that are useful to themselves and useful to their city. They help by sending reports to headquarters, by being careful never to toss waste of any sort into the street, and by encouraging others to be as thoughtful as they themselves are in everything that pertains to the welfare of the city.

For two reasons it is best to let the street cleaners themselves do the actual work of gathering city rubbish:

1. Because no one knows what variety of disease microbes may be on it.

2. Because street cleaners have convenient tools for the work and do not need to touch the rubbish with their hands.

The truth is, of course, that no boy who has once been a member of an active juvenile league can ever be entirely thoughtless about his duty as a citizen. Indeed those who are children to-day will be voting citizens soon, and the better acquainted they are with city laws and health laws, the better prepared will they be to serve the city both as voters and as officers.

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CHAPTER VII

GARBAGE, ASHES, AND RUBBISH

To avoid mistakes from ignorance and carelessness, the street-cleaning department of New York City has published cards which give definite instructions. The copy which I own has a queer pink color, — to keep it from being lost among white cards, I suppose, — and there are directions on both sides of it. As every word is important, both sides are printed on the following page.

When all good citizens have followed the directions of their different cards, and when the street sweepers have gone through the streets with their two-wheeled bag carriers that stretch the bags open to receive the dust, with their empty jute bags to hold the sweepings, and with their long broom, their short broom, and their sprinkler; when finally they have filled these bags with the sweepings, tied them up, and put them on the edge of the sidewalk to be taken away, then the carts and the horses pass slowly down the street and collect the different wastes of the city, — the garbage, rubbish, ashes, and street sweepings.[1]

[1] In 1906 there were 1316 drivers of carts that collected this city waste.

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DEPARTMENT OF STREET CLEANING, 13 Park Row, N. Y. City.

It is forbidden by City Ordinance to throw any scrap or article into the street, or

PAPER, NEWSPAPERS, Etc.
ASHES OR DIRT.
GARBAGE OR OFFAL.
BANANA SKINS.
ORANGE PEEL AND THE LIKE.

GARBAGE WILL BE COLLECTED BEFORE 12 O'CLOCK, NOON.

Do not sweep the dirt from the sidewalk into the street. Sweep the dirt into a pile on the sidewalk, pick it up and put it into the ash can.

To sweep the dirt from the sidewalk into the street after the street has been cleaned is a violation of the law. **Keep your sidewalks clean.**

THIS LAW WILL BE STRICTLY ENFORCED.

JOHN McGAW WOODBURY, Commissioner.

It is on this point that citizens are most likely to be ignorant and therefore careless. They do not always

DEPARTMENT OF STREET CLEANING, 13 Park Row, N. Y. City

KEEP YOUR MATERIALS SEPARATE

The Sanitary Code Section 108, requires householders and occupants to provide separate receptacles for Ashes and Garbage and forbids mixing these in the same receptacle.

THIS LAW WILL BE STRICTLY ENFORCED.

GARBAGE PUT INTO GARBAGE RECEPTACLES	ASHES PUT INTO ASH RECEPTACLES	RUBBISH PUT INTO RUBBISH BUNDLES
Kitchen or Table Waste	Ashes	Paper, Pasteboard, Etc.
Vegetables	Sawdust	Rags, Mattresses, Carpets
Meats	Floor Sweepings	Old Furniture, Oil Cloths
Fish	Street Sweepings	Old Shoes, Flower Stems
Bones	Bottles	Leather & Leather Scrap
Fat	Broken Glass	Tobacco Stems
Fruit	Broken Crockery	Straw and Excelsior (From Householders only.)
	All Tin Cans	(All rubbish such as described in this column must be securely bundled and tied. Boxes and barrels filled with paper, etc., will be removed with contents, and the boxes or barrels will not be returned.)
	*Oyster and Clam Shells	
	*Oyster and Clam shells will not be removed from fish dealers, but must be removed at their own expense.	

All rubbish described in third column must be kept in doors, and when ready for removal the Red "P. & R." must be hung in a conspicuous place, and the driver of the paper cart will call for such rubbish.

JOHN McGAW WOODBURY, Commissioner.

know why the city takes such pains to put different articles into different receptacles. Indeed, thousands of

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people have no idea what becomes of the waste after the carts have moved out of sight around the corner; yet its destination explains the need of separating one kind from another.

Before 1896 very little separating was done. All kinds of garbage and rubbish went into the same carts, at the same time, and were carried to the same dumping boats.

UNLOADING GARBAGE WITH PITCHFORKS

There rag pickers and bone pickers paid the city for the privilege of sorting out what they wanted, while the rest of the terrible mixture was taken ten miles out to sea and thrown overboard.

Naturally enough, winds and storms drove part of it back to shore again. One of the regular complaints at the bathing beaches was that boxes and barrels, melon

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rinds, cabbage leaves, and truck of every sort annoyed the bathers by floating around among them or drifting upon the beaches.

Colonel Waring decided that the whole system of ocean dumping was untidy, unsanitary, extravagant, and disgraceful for so large a city as New York. He therefore appointed committees to study into the subject of city waste. And the work which he did through these committees is the basis for what New York City is doing to-day. Their first decision was that different kinds of refuse need different kinds of treatment. This meant that each kind must have its separate receptacle at each house, and its separate cart to carry it to its special destination. The committees then arranged it all so well that these destinations have now become as interesting as any other sights in New York City.

Visitors to Riker's Island believe this. They see that instead of throwing hundreds of tons of ashes, street sweepings, and rubbish into the ocean every year, New York is actually making solid ground out of these waste things.

It costs the city about ten thousand dollars an acre to make the land; but when it is made it will be worth at least twelve thousand dollars an acre, — which shows pretty good management.

The steps to the land making are these. Ashes from the ash cans of the houses and bags of street sweepings

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from different parts of the city are gathered up by the ash carts. Neither this nor any other kind of cart that carries city waste is allowed to trot through the streets. For this reason everywhere they move in slow processions, first loading up, then traveling to different places on the water front, where they dump their contents. Sometimes the sweepings are sold to people who buy

AN ASH CART COLLECTING FOR RIKER'S ISLAND

them to use as fertilizers; otherwise the ashes and sweepings go in scows to Riker's Island in East River. There they are dumped, and the land grows fast. During each month of 1903 over one hundred thousand cubic yards of ashes went into the inclosures which are being filled to make this island. It cost the city seventeen cents a cubic yard to get it there.

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The ashes are packed in until the new land stands six or eight feet above water at high tide. Then, instead of more ashes, sixteen inches of good earth is added, so that trees and grass may finally have a chance to grow on the manufactured island.

To start with, Riker's Island was only eighty-seven acres in extent. But the plan is to turn it into a three hundred and twenty acre island. It will then be twice as large as Blackwell's Island. When the work is done

BUILDING RIKER'S ISLAND

New York City may move her hospitals and her penitentiaries from Blackwell's to Riker's Island. Thousands of people are hoping that when that time comes Blackwell's Island will be turned into a beautiful park with athletic grounds for the city.

So much for the good management that turns ashes and street sweepings into valuable land. But the fate of rubbish bundles is quite as interesting.

These are gathered by large carts, because the loads are lighter and more clumsy. In these loads every sort

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of thing is found, from rags and tobacco pipes to worn-out mattresses and useless carpets. In truth, many people cast aside all sorts of things that can be used by other people. There is so much of this done that contractors are willing to pay the street-cleaning department

SORTING CITY RUBBISH

thousands of dollars a year for the privilege of picking out what they want from this rubbish before it is burned up or thrown away.

The modern method is for the rubbish bundles to be cut open and spread on what is called a moving belt.

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The unloading with shovels and pitchforks is simple enough; then follows the interesting part of the process. All that mass of garbage is put into monstrous kettles that hold eight tons apiece, and there, with a good deal of water, it is steamed steadily for eight hours. Besides the fragments and remnants of food, the potato skins

DIGESTERS IN A ROW ON BARREN ISLAND

and banana skins for nearly four million people, dead horses go into the digester, too; also dead cats and dogs. Any animal that dies on the streets of New York City ends by being a part of the eight-ton stew in one of the digesters on Barren Island. Altogether there are about one hundred of these digesters.

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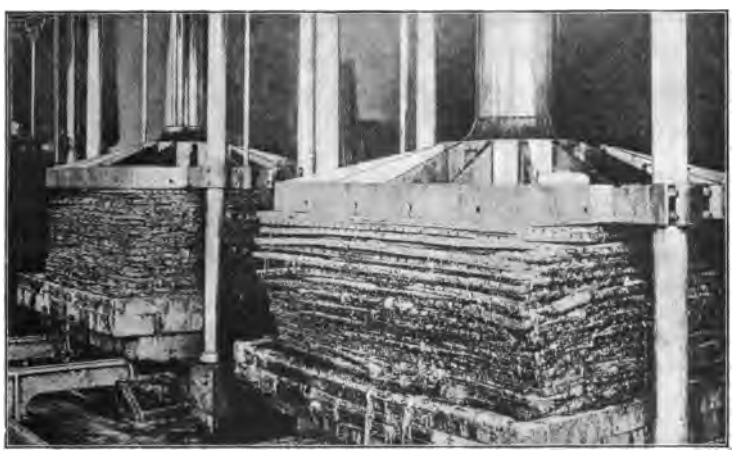
When the steaming is over the cooked garbage is sent into presses, where powerful machinery squeezes out the water and the fat. Cooling now separates the two, and the mass of grayish, brownish fat which rises to the top is packed in barrels and sold in Europe and America for soap grease, for pomatum, and various other purposes.



SQUEEZING WATER AND GREASE FROM COOKED GARBAGE

It is claimed that whatever disease microbes were in the garbage to start with have been killed by the heat, so there is not the slightest reason why the fat should not be used in any of these ways.

The solid part of the stew is dried, crushed, sifted, and sold as a base for fertilizers.

Of course it is supposed that nothing but garbage goes into these city digesters. But, strange to say, when

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it comes to the sifting, all sorts of things turn up, — silverware, boots and shoes, cans, jewelry, and false teeth. Dr. Woodbury says that hairpins are the worst: they clog the sifting machine. Yet so many are found in it that they are picked out by the ton and sold to the wire works to be used again.

These things get into the digesters because careless people have tossed them into their garbage cans. Remember that when things are put into the wrong can some one has twice as much trouble at the other end. The man who is most loyal to his city shows it as much by the manner in which he cares for his rubbish as by paying his taxes or by going to the polls and voting for upright city officers on election day.

The street-cleaning department of New York does three great things with waste materials:

1. It turns ashes and street sweepings into valuable land.

2. It turns garbage and dead animals into soap fat and fertilizers.

3. It sells part of the rubbish and burns up the rest. At the same time the heat that comes from the burning is so great that it is used to run the engine which moves the belt. And probably, when larger incinerators are built, it will be possible to light a part of the city with electricity generated by the engines.

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Most important of all, the department keeps the city clean. Thus it heads off disease microbes and preserves the health of citizens. This indeed is what every city should do for itself.

New York leads the cities of the United States in the way in which it gets rid of refuse. This is so true that at the world's exposition in St. Louis in 1904, one of the most interesting exhibits in the New York Building was that of the street-cleaning department of New York City. Students of such subjects, from all parts of the world, took time to examine it thoroughly,—learning what they could for their own use in their own land.

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CHAPTER VIII

PARKS, PLAYGROUNDS, AND PUBLIC BATHS

The Spartans were courageous Grecian people who wished to fill their country with vigorous men and women. To accomplish this they did two things:

1. They killed deformed children.
2. They did all they could to keep the other children well, giving them plenty of outdoor air and exercise.

Modern cities are like the Spartans in one way, at least; for though they do not kill their frail babies on purpose, they allow them to live in places which do kill them quite as surely as if the deaths were planned for.

The truth is that neither New York nor any other large city has ever been very careful to follow the second Spartan rule about caring for the health of the children. For years, however, they have tried to help the situation by making what they call "lungs," — that is, parks and playgrounds for their citizens. There was great discussion about this in New York City, and in the midst of it a committee of men who were looking up the matter pretty thoroughly hit on a new strong argument for parks.

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They made a map of the city which showed, by green squares, where the parks and playgrounds were; then they called in police captains from different districts and asked them to point out on the map where restless boys

MULBERRY BEND AFTER IT BECAME A PARK

gave the most trouble. Queerly enough, in every case those policemen put their fingers on the spots where there were neither parks, playgrounds, nor trees. The committee thereupon put a dash of red on each of these troublesome places.

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Other policemen said that the boys gave them no trouble whatever; and when they in turn pointed on the map, behold their districts were in the region of parks!

That was the new argument. The committee saw at once that, besides making boys healthier and happier, parks did certainly turn them into better citizens.

The committee next stuck pins into the map to show where the schools were, for they wished to know where the children were thickest. They then sent this strange-looking map to the mayor of New York; and with it they sent the copy of a law which the state of New York had made for the city. I give it here:

The people of the state of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. Hereafter no schoolhouses shall be constructed in the city of New York without open-air playgrounds attached to be used in connection with the same.

As it happened, wherever the pins were thickest on the map, showing the most children, there the red spots were thickest too, betraying the boys. No wonder this attracted much attention; for it was easy to see that if red spots were thickest where schools were thickest, the only sensible plan was to put green spots into those very regions and drive red spots out. In other words, the law was the most sensible thing in the world, for it proposed to hitch schoolhouses and playgrounds together for the benefit of the children. The city therefore obeyed.

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This law was passed in 1895. Between that time and 1902 New York City put up sixty-nine new public-school buildings in Manhattan and The Bronx; and each one of the sixty-nine had its own playground. Six of the largest and finest of the buildings were put into the most crowded parts of the city. In these places land is so valuable that a part of the newest scheme for playgrounds is to put them on the roof of the schoolhouses themselves. This lifts the children above the dust of the street, giving them the purest air to breathe while they frolic and exercise. The roof playground on Hester Street holds two thousand romping children.

In 1903 New York City looked up the subject and found that she had over eleven hundred acres of ground in her different parks, — surely quite a large tract of land. But, sad to say, Central Park and Riverside Park used up all but one hundred and fifty-seven of those acres; so that the rest of the city, where most of the people live, had only one hundred and fifty-seven acres to be distributed about in small patches here and there. This gave but forty acres to the million and a half people who lived in the most crowded part of the city. New York is therefore laying plans for more parks and school-roof playgrounds.

Other cities everywhere are doing the same thing. Between 1898 and 1902 Boston, for example, bought up one hundred and fifty of her own worst tenements, also

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eighty stables, pulled them down, carried them away, and in many cases put parks in their places. She also has a great system of parks, which covers over eight thousand acres round about the city.

Yet quite as important as anything else is the Boston system of beach baths which were in use even fifty years

OCEAN BATHING AT WOOD ISLAND PARK BEACH

ago. To-day the North End bathing beach is so absolutely free to everybody that during the season the bathing suit itself is lent free of charge. At Boston's other city beaches, however, five cents are charged for the use of the suit.

The same facts are true all over the country to-day; that is, in certain places the baths are absolutely free,

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while elsewhere three or five cents are charged for the use of towel and soap.

Going west, we find that Chicago has the honor of being the first city in America to give her people free public baths all the year round. Other places are, however,

SATURDAY MORNING AT DOVER STREET BATH HOUSE
Boys waiting their turn

following in her footsteps; and to-day the United States is the only country in the world where there are cities that give baths to their citizens as free as the air they breathe. In Europe and in England a fee is always charged for the public bath. This is also generally true in the United States, although here the number of free

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baths increases every year; and they help to raise the standard of cleanliness.

Clearly enough the need is very great in New York City, for although the streets are cleaner than they were, although the tenements are in better condition, and the parks increasing in number, still in 1901 some one discovered that a particular district in the city had just three bath tubs for the use of 1321 families. This did not prove that those people did not want to bathe; it simply showed they had very little chance in that direction.

With thousands of people going without any real bath for months together, the danger of illness is increased both to the unwashed persons themselves and to their neighbors, for disease microbes thrive best on unclean people.

Since New York believes this fact thoroughly, she is providing public baths as fast as possible. Some are in use already, others are being built, others yet are planned; and when all are finished they will supply the city with thirteen million free baths a year.

Those who bathe in that city often pay no money for the privilege; nevertheless they do supply their own soap and towel, and they go to the baths by tens of thousands every month. During the first five months of 1902 over two hundred thousand people used the Rivington Street bath, while in the People's bath,

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where a nickel is charged for the use of soap and towel, 121,386 of these bits of money poured in during 1901.

SHOWER BATHS AT THE DOVER STREET BATHHOUSE, BOSTON

Along with all these facts it is well to know that public city baths have to be arranged with three things in mind:

1. To accommodate as many bathers as possible.
2. To be as inexpensive as possible.
3. To run no risk of distributing disease microbes from one person to another.

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Some places supply tubs; others supply shower baths. The objection to the tub is the time and expense of it, for not only must it be filled for each person, but it must be emptied as well; it must also be thoroughly scrubbed between the baths lest some contagious disease pass from one person to his successor in the bath tub.

The advantages of the shower bath are:

1. No time is spent in filling tubs, in emptying and scrubbing them.

2. The expense of the shower is less than that of the tub bath, because less water is used and because the apparatus costs less in the first place.

3. No person runs the slightest risk of being touched by water that has touched another person. He is therefore safe from any contagious disease which another might have had who went before him.

When a crowded city district receives the gift of a park, a playground, and a public bath, it has reason to expect to turn out healthier, happier, and better citizens than it ever did before. This is what Seward Park is helping Hester Street to do. The place cost New York City a little over eighteen hundred thousand dollars. It was opened in 1903, and it was the first park in the city to be planned as a playground supplied with gymnasium apparatus. More than that, the apparatus is free

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for public use; and even Spartan children would have enjoyed it. See how much they have:

Swings, teeter balls, tennis, volley ball, croquet, rings, teeter ladders, trapeze rings, giant stride, tenpins, Indian clubs, jumping ropes, sand boxes, horizontal bars, parallel bars, chest bars, horizontal ladders, inclined ladders, trolling rings, flying rings, bucks, horses, climbing ropes, climbing poles, inclined poles, basket-ball courts, running track, also a set of standards for pole vault and the high jump.

A Corner of Seward Park

Lined up for a swing

All this apparatus is to be found at Seward Park; and there is the beautiful pavilion besides, with free shower baths for dusty men and women and for tired boys and girls after their gymnastic practice.

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CHAPTER IX

FIRES

In his book *Out of Mulberry Street* Mr. Riis describes the work of one of the New York "heroes who fight fire."

There was the clanging of bells, the rush of engines, the blazing fire in a great building, and a small boy

A Fire Engine

who clung to a ledge so far up that even the extension ladders were too short to reach him. But there was yet the scaling ladder, — the slender pole with a hook on the

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end and bars across it for steps. A fireman used this. One by one he crashed the hook through the windows above him and climbed the pole like a fly against the wall until he reached the boy.

As he took him in his arms the fire burst out above them. But slowly and surely he crept back by the way he had come. And when they reached the ground together the crowd knew that the fireman was a hero. A great shout went up. Women cried, while strong men acted as if they had lost their wits. They laughed; they shook hands; they clapped each other on the back. And no wonder, for they had seen a man risk his own life to save the life of another.

THE SCALING LADDER

The hook at the top will be turned to catch over the window sill above it

That is not a rare case. Deeds like that are done every year by brave firemen, though the man who does it is apt to be the one who says the least about it.

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A man does not save another by accident. He has to know how. He strives for it; he drills for it. But before the striving and the drilling there must come a clear head and steady nerves, for the drill tests both of these.

A WATER TOWER
It pours a stream of water into a high building

When he drills a man must learn to jump from a third-story window into a fire net without a moment's hesitation; he must be strong enough and skillful enough to use the slender scaling ladder; he must learn to pull a fellow fireman through a fourth or fifth-story window and carry him safely to the ground. He must also be able to relax his muscles; he must act as if he had fainted and let another man carry him down the dizzy ladder as if he were the one being rescued. He must learn how to stand in any perilous place without being dizzy; he must be ready to do any dangerous thing without being afraid. Truly a fireman needs to be as brave as he is strong.

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If he finds that he loses his head, or is dizzy or afraid; if he cannot climb and jump fearlessly, and crawl through suffocating smoke, he may be useful somewhere else in the world, but he cannot be a successful fireman. In 1903 there were over seven thousand men in the service in Greater New York, and the city paid about five million dollars for their services that year.

No doubt their hardest work is in the tallest tenement houses, because the greatest danger and the greatest suffering are just there. At the same time almost half the fires of New York City are in those very buildings. New York learned this when her tenement-house commission studied up the subject of air shafts and fires.

It seems that ever since air shafts were first put into buildings firemen have said that they act like huge chimneys, drawing the fire up and flashing it into every window on the way. This is evidently true, for the same commission investigated the course of three hundred and twenty-nine great tenement fires, and found that fully one quarter of them rushed through the buildings by the air-shaft road; that one fifth traveled through halls and stairways, while another quarter burned their way through floors and partitions. They accordingly decided that:

1. Air shafts must not be allowed in new-law tenement houses.

2. Public halls and stairways must be made fireproof.

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Two fires during the same day, one in fireproof halls, the other in non-fireproof halls, showed what the difference is when a fire once breaks out.

The non-fireproof halls were in Jackson Street. There the fire raced through them to the halls above; it spread along the corridors, reached almost every room in the building, and traveled so fast in every direction that before the occupants could all escape eleven were killed and six more injured.

The other fire was in Rutgers Street. It could spread neither far nor fast because both halls and stairways were made of slate and iron, — that is, they were fireproof. Of course there was some woodwork about them, and it was burned; but it made no terrible blaze; and when the fire reached the upper stories it found doors that separated one hall from another, while the flames were only hot enough to scorch the doors on the side towards the fire.

Whether the halls are fireproof or not, however, New York demands fire escapes on every tall building. They are as necessary for the entrance of a fireman who is to save a child as for the escape of a child who can save himself. The law requires them on both the front and the rear of each tenement.

When they are omitted sad results sometimes follow. This was the case in January, 1900. A fire broke out on First Avenue; and when the firemen arrived the stairs were in flames, while the wind blew other flames

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around the rear fire escapes. There were no fire escapes in front, so that people above the second story could not leave. The firemen worked tremendously for five and a half hours; they used extension ladders, scaling ladders, and jumping nets, and succeeded in saving everybody except Loretto Leonard. He was six years old and was suffocated on the fifth floor before they could get him down.

THE RIGHT KIND OF FIRE ESCAPE

In cases like that all depends on the firemen, and they cannot always save every one.

Yet even when there are escapes enough, the way in which they are built makes all the difference in the world in their usefulness. Vertical ladders are so dangerous that women and children hardly dare to climb down on them. This means that unless

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the firemen carry such people down one by one they are not saved at all.

Even with the best of fire escapes, however, there may be awful tragedy. This happens when barrels, boxes, plants, rags, and rubbish are loaded on the fire escapes and balconies, as occurred in New York City in March, 1905. Over forty citizens were injured in that

AN ENCUMBERED FIRE ESCAPE

fire, and nineteen were burned to death. Some were on the fire escapes; they had tried to climb down, but rubbish of every sort had caught them there and hindered them until even the firemen could not save them.

There are strict laws against encumbering the fire escapes, and the fine for breaking the law is ten dollars.

If you are ever caught in a burning building where there is no school fire drill to obey, do as the fireman

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does in one way at least; that is, keep a clear head, think fast, and end by doing sensible and not foolish things.

When you are sure there is a fire, shout aloud to notify others. Then run down the stairway if it is not on fire. If it is on fire, go out at once to the fire escape; keep a steady head and climb down carefully step by step. If there is no fire escape, stand up in a window and look down. The firemen will see you and they will hold out a jumping net. When they do this, do not hesitate an instant; look up into the air now and not down; let all your muscles be relaxed so that you will not strike with an extra bound when you reach the net, and as you are looking up step off into the air. In two seconds you will be safe in the net.

Quickness and a clear head have saved the lives of scores of people. They are especially useful when a fire breaks out in a school building.

In Detroit, Michigan, on the 15th of March, 1905, there was such a fire. Six hundred children were in the building at the time. The fire started in a closet full of flags and ended by burning up those flags. But as soon as the gongs were sounded as a signal for fire drill the children fell into line and marched out in perfect order. Some of the little girls cried afterwards, when the firemen came and put out the fire, but they marched like heroes as long as they were in danger.

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In New York City, February, 1905, the boys in a private asylum on One Hundred and Seventy-sixth Street were even more successful, for they not only marched out of the building but they formed a fire brigade. They laid two lines of hose to the hydrant, turned the water on the blazing timbers, and worked so well under the man who guided them that when the regular firemen came there was nothing for them to do. The fire was so nearly out that the chief fireman simply congratulated the boys and their leader and went away.

I might go on mentioning case after case of the same kind, for thousands of other American schools are able to march to safety by the fire drill. It is even more important, however, that each separate child should learn to be careful about starting fires by accident.

CAUSES OF FIRES IN NEW YORK CITY DURING JUNE, 1900

Careless use of matches	32	Gas explosion	11
Upsetting kerosene lamp	4	Bedding and sofa fires	11
Gas jet	5	Cellar rubbish igniting	13
Fat boiling	3	Firecrackers	6
Foul chimney	10	Spark from locomotive	1
Electric wire	1	Not known	97
Incendiary	1	Clothing and furniture too near stoves	22
Carelessness with candle	18		235

Read the preceding list of two hundred and thirty-five fires and pick out those that came from carelessness. See how few others there are. The list is quoted from *The Tenement House Problem.*

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To help save our neighbors and ourselves from fire, let us never run risks through carelessness with matches, with candles, with firecrackers, or with anything else.

FIRE ESCAPE BALCONY AND STAIRS, ENCUMBERED

Let us also help our city by noticing whether the fire escapes are kept clear. If you find one that is not clear, you might drop a postal to the fire department. You do not even need to sign your name; simply say:

The fire escape at —— is encumbered.

A YOUNG CITIZEN.

Remember that you have the right to help make your city safe and beautiful.

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CHAPTER X

GOOD BUSINESS AND ALCOHOL

Not only are cities growing more economical in saving what they once wasted and making money where they once lost it, but the same rules are controlling business in every part of the country. A certain change in the way alcohol is used shows this.

Formerly railroad men in America were supposed to use alcohol as a matter of course. Saloons were thick near every station, and trainmen visited them whenever they pleased. At that time those who did the drinking were not the sort of railroad men we see to-day. On the contrary, in certain directions, no one expected much of them. They worked hard, drank often, had no high respect for themselves, and were not greatly respected by others.

To-day, however, the railroad employee is almost always a self-respecting, well-clad, strong, and reliable man. His officers are proud of him, while he is proud of his occupation. The change has not come suddenly, but step by step, just as the business itself has grown. Yet the contrast between the past and the present is very striking.

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Eighty years ago locomotives weighed two and one half tons in the United States. Cars were small and few. Passengers traveled by hundreds instead of by thousands, and trains moved at the rate of thirty miles an hour when they went their fastest. But now (in 1906), some locomotives weigh almost two hundred tons. They can travel seventy-five miles an hour, and they carry millions of passengers every year. Here are a few official figures for 1902. Notice the size, but do not try to remember them.

Miles of track	202,492
Number of locomotives	50,000
Number of cars	1,640,000
Number of passengers carried	649,878,505
Amount of freight (in tons)	1,200,000,000
Employees	1,189,315
Capital involved	$12,134,182,964

These figures show that the railway tracks of the United States are long enough to reach to the moon and to go around the earth besides. They show that there is more money invested in the railway business than in any other business in the country. They show that over one million people take charge of the lives of six hundred million other people who travel by rail. And perhaps they show, most of all, that the success of the whole enormous business depends on faithful work done by faithful men.

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When huge trains are traveling at the rate of a mile a minute, and when through some carelessness there is an open switch or a wrong light and a frightful collision, not only are innocent human beings crushed, burned, and killed, but the railroad companies have enormous bills to pay. They must repair their locomotives, rebuild their cars, relay the twisted track. More than that, they must pay damages to wounded men and women, and pay thousands of dollars to the heirs of those who have been killed.

All this happened to the Lake Shore Railroad Company after an accident in June, 1905. The train was moving its fastest when the crash came. Nineteen men died, others were wounded, and the cars and locomotives were wrecked. That one accident is supposed to have cost the company not less than five hundred thousand dollars.

When wrecks and death mean such loss as that, any good business firm does all it can to prevent them. So in the railroad business especially every car, engine, and boiler must be well made; every track must be well laid; every switch must be closed when the right moment comes. Every flagman, brakeman, switchman, track walker, conductor, and engineer must be intelligent, absolutely reliable, and brave. Each must be ready to act on the instant in case of accident; yet each must be so careful and clear-headed that no act of his will ever bring about an accident.

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Probably no business company in the world has studied men more carefully than railroad companies. They need to know whom they can trust, and how to get hold of worthy men; and they have had no way to learn except by experience.

At first very little was said about alcohol, for in early days almost everybody used it. But when it was noticed that accidents came oftenest from the carelessness of those who drank alcohol, and when the company realized that the more their men drank the more money they themselves lost, they saw it was poor business. They then decided that no one should work for them who ever allowed himself to get drunk. This was the first step, and it was an improvement.

Nevertheless they still kept an eye on the accident record; and they saw that, after all, the really reliable men were those who not only were never drunk but who never drank while on duty. The company therefore took another step, and made it a law that no man should drink while he was at his work. This kept thousands of men steadier then they had ever been before. Travelers were safer, too, but even yet it was plain that the most reliable men of all were those who never touched alcohol, either on duty or off duty. Indeed, such men were now in great demand every year. They were surest to receive good places, and surest to keep them.

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Both the character and the appearance of the railroad man changed fast after that. He stopped acting and dressing as if he belonged to the saloon. Instead, he finally looked and acted as if he belonged to the splendid railroad system of the country. These men became self-respecting, and they were greatly respected.

Having gone as far as that in temperance work, the railroad companies now took the most important step of all. Several united in what is called the American Railroad Association. This covers something like one hundred and sixty thousand miles of track, with cars, engines, passengers and trainmen to match.

In 1899 the Association adopted the following strict rule: "The use of intoxicants by employees while on duty is prohibited. Their habitual use or frequenting of places where they are sold is sufficient cause for dismissal."

That law covers the drinking habits of hundreds of thousands of men, and it is strictly enforced. Not only so, but other railroad companies are even more strict.

The Central Vermont Railway says, "We require from employees engaged in train service total abstinence at all times, whether on or off duty." The Toronto, Hamilton, and Buffalo Railroad Company's rule is, "The use of intoxicating liquors is forbidden under any circumstances;" and men who want to work on the International and Great Northern Railroad have to sign the following pledge:

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"If this application is accepted, I agree to observe all rules and regulations of this company; to abstain from the use of intoxicating liquors, not to visit saloons, places of low resort, or where liquors are sold, etc."

With railroad after railroad doing the same thing, the end of it all is that, in the United States in 1906, about a million railroad men have to be total abstainers from all alcoholic drinks, or run the risk of losing their positions. This makes the railroads of the country the largest, the strongest, and the strictest temperance society in the world. It is powerful because it turns a man out of business if he breaks his pledge.

The curious part of this society is that it does not work for temperance because it is anxious about the health or the happiness of the men themselves, but simply because it is determined to do good business, to save waste by accident, and to make as much money as possible.

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CHAPTER XI

GOOD BUSINESS AND ALCOHOL (*continued*)

Life-insurance companies are money-making affairs, too, and some of them are doing as good temperance work as the railroads.

In the first place their arrangement with people is this: When a man gets his life insured he promises to pay the firm a definite small sum of money every year as long as he lives, and in return the firm promises to pay his heirs a definite large sum when he dies. Plainly enough, the longer the man lives and pays the money the better the company likes it; while the man himself is glad to do the living even if he has to do the paying. So it turns out that long life satisfies both parties.

As for what alcohol has to do about it, the proof has come in a natural way. For generations people have been talking about the effects of alcohol on health. Some thought it lengthened life; others thought it shortened life; but there were no figures to prove the case either way until after 1840. At that time a new sort of insurance society was started in Great Britain with a monstrous name, — The United Kingdom Total Abstinence Life Association, for the Mutual Assurance

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of the Lives of Total Abstainers Only. Later the name was changed somewhat, and other people were allowed to be insured in the same company.

Since then the two parts of the society, — one for abstainers, the other for non-abstainers — have gone on side by side; but all the records of the lives and all the records of money paid and received have been kept separate. At the same time the men in each set have had the same sort of medical examination before they were accepted, and they have come from the same class of English people. In fact, in everything except alcohol drinking they have been alike.

Now come the interesting facts. The records cover sixty-one years. They run from 1840 to 1901; and the reports which Mr. Moore made for the society in 1903 are filled with long tables of figures. Still the case can be given here in a nutshell.

It seems that all insurance societies use certain sets of figures to show how long people are likely to live after any definite age. For example:

At 20 a healthy man may expect to live 42 years.
" 30 " " " " " " " 35 "
" 40 " " " " " " " 28 "

These tables cover all ages, and they were made up before any one thought that taking alcohol or going without it could make any difference in the length of time a man might live.

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For this very reason, perhaps, they are specially valuable now, for they are the standard; and by comparing the record of a man's life with the standard we know whether he has lived longer than he was expected to live or whether he has died sooner than he was expected to die.

This brings us back to the first temperance society with the long name. By crowding Mr. Moore's tables into the smallest possible nutshell, we find that during those sixty-one years, out of every hundred non-abstainers four more died than were expected to die; while out of every hundred abstainers twenty-five more lived than were expected to live. Or, to make the figures of the society plainer yet:

DEATHS DURING SIXTY-ONE YEARS

Among abstainers	1775 fewer than expected.
Among non-abstainers	36 more than expected.

Mr. Nelson, another Englishman who is in the life-insurance business, has separated the statistics of moderate drinkers from those of total abstainers and has found out what the different standards of life expectation are for the two sets of people. This is quite a different matter from the standard which was made from the statistics of drinkers and abstainers mixed together.

The first table shows how many moderate drinkers die between certain ages as compared with the total abstainers who die between the same ages:

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Age	Moderate Drinkers	Total Abstainers
Between 15 and 20	18 die for every	10
" 20 " 30	31 " " "	10
" 30 " 40	40 " " "	10

If a man wishes to know just how old he has a right to expect to live to be, he may consult these other figures which Mr. Nelson gives. Such a man can tell his prospects by the column of figures to which he happens to belong:

Age	Moderate Drinkers	Total Abstainers
At 20 expect to live to be	35	64
At 30 " " " " "	43¾	66½
At 40 " " " " "	51½	68

When a moderate drinker learns these facts and does not decide to be a total abstainer, it is clear that he is perfectly willing to rob himself of his own life.

These different facts have not only set people to thinking, but they have also induced other insurance societies to examine their records. By doing this they find that in every case where they have recorded abstainers and non-abstainers separately the result tells the same story about abstention and long life. The figures are, indeed, so convincing that, in certain insurance societies, the man who is a total abstainer does not have to pay so high a rate as the man who sometimes uses alcohol.

After all, however, boys are far more apt to be interested in the business of athletics than in life-insurance

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societies; and without being told anything about it, they know that in these days almost every coach who trains college men for football, baseball, or athletic sports of any kind, positively forbids alcohol. Each one says he is training his men to win and that he will not risk alcohol.

In 1901 the captain of the Princeton football team wrote: "Beer and other alcoholic liquors are never used. I think a team is better off without them." This word comes from Cornell: "I have found that young men are much better off and do better work without than with them. They are therefore absolutely prohibited." Other universities are just as firm.

Whichever way we turn, therefore, we find that the habit of never touching alcohol is like a strong engine pulling a man along the road to success.

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CHAPTER XII

WATER SUPPLY FOR NEW YORK AND WATER WASTE IN CITIES

For a city like New York, which is growing fast, and using more water with each step of growth, one of the most important questions is, how to get enough of it to escape a water famine during dry weather.

One hundred years ago the city had sixty thousand inhabitants; yet even then they were in need of more water. To get it they dug a well twenty-five feet across and thirty feet deep, sending the water to the people in pipes. Seven years later the city was twice as large. They now dug another well, sixteen feet across and one hundred and twenty-two feet deep. After that, well followed well, until 1834, when the demand had so far exceeded the supply that men were bringing water in barrels and in hogsheads from springs in the country. They sold six hundred hogsheads a day at a dollar and a quarter apiece.

But no city can keep on growing and depend on that kind of water supply. The people therefore made plans. They studied the creeks, the springs, and the rivers for miles around, and ended by deciding to use Croton River,

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forty miles away. The water was pure and there was enough of it; the only objection was the distance from town. But a dam was built across the river; and with stone, brick, and cement an aqueduct was made, eight and a half feet in diameter and forty miles long. It passed through sixteen tunnels and finally crossed a bridge into New York City.

If you ever visit High Bridge, try to remember that it is over a quarter of a mile long, that it is one hundred and sixteen feet high, and that it carries eighty million gallons of water into New York every day. It has been doing this ever since 1842. At that time it was the wonder of the year; but by 1890 the city needed so much more water that another aqueduct had already been built and was ready for use.

New York has built reservoir after reservoir to hold the rain that falls anywhere in that region; and draws from these in dry weather. In 1905 another huge Croton dam was ready to store up more water than New York had ever before collected. Near the end of its construction, the men worked hard and fast and over time. The reason was that every day the city was using fifty million gallons more water than could be obtained during a dry season. This meant that if there had been several months without rain before the dam was ready to use, New York would have suffered from that awful thing, a water famine.

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This almost happened in 1900; for during that year for two hundred and fifty-five days more water was used than fell in rain. In fact, there was finally only enough left in the reservoirs to supply the city five days longer. If a great fire had broken out just then, I suppose

CROTON DAM BEFORE IT WAS FINISHED

Here thirty billion gallons of water are kept in storage for New Yorkers

the city would hardly have dared to spare enough water to put it out.

Fortunately, however, rain came instead of fire; and it poured so steadily for twenty-four hours that every reservoir and bed was full and running over. Of course this narrow escape showed the city that it must have

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more water as soon as possible; and that explains the rush the builders were in as they were finishing the new dam.

It was thirteen years building; and it is so much longer and broader and higher than the old dam that the water it holds back has flooded out of sight that other one three miles farther up the valley. All that a visitor sees now is the wide, beautiful, artificial lake that stretches back into the narrow valleys. It stores up water enough to supply New York City for a dry season of one hundred days.

The new aqueduct that carries this water to the city is fourteen feet high.

Read the following figures, but do not try to remember them. In 1904 Greater New York used three hundred and seventy-five million gallons of water each day. Those who know best say that even now the city ought to have enough to allow at least five hundred million gallons to be used every twenty-four hours. Indeed, that is what is now being planned.

Already engineers, chemists, and bacteriologists have been sent into all parts of the state to examine the water and its availability. They have visited the Hudson River to its smallest branches; they have studied all the streams of the Adirondack and Catskill mountains.

In fact, they have examined every stream, mountain, and valley in the state; and the report of the work is printed

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in a book of nine hundred and eighty pages, with maps to illustrate it from beginning to end. This tells just where the best water can be found; how many dams must be built in this place or that to make the lake that would be needed as a reservoir; how many people and villages would have to be bought out and moved to make room for such a lake; how long and how large the aqueducts would have to be to carry the water to the city; and in every case they tell, as nearly as they can, what the whole will cost. All that the city has to do, then, is to decide where to go for additional water, choose engineers and workmen, set them to work, and pay the bills.

But how does New York, or any other city, know how much water will be used each year? She knows from her own experience and from the experience of other cities. After all, however, there is a great difference in the quantity of water which different cities use and waste.

Massachusetts has learned this from the reports of the Metropolitan Water District. There are eighteen towns and cities in the district, and the water for each goes through meters and is measured on its way to town. The last column of the table given on the next page shows that there is no regular rule about the quantity taken by each town; and that they allowed all the way from forty-four to one hundred and thirty gallons a day for each person.

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DAILY AVERAGE (TWENTY-FOUR HOURS) OF CONSUMPTION FROM THE METROPOLITAN WORKS, JUNE 28, 1903, TO JANUARY 2, 1904.

City or Town	Population	Average Daily per Capita (by Gallons)
Arlington	9,845	84
Belmont	4,875	47
Boston	602,175	130
Chelsea	36,125	94
Everett	28,450	81
Lexington	3,600	68
Malden	37,315	47
Medford	21,035	78
Melrose	14,015	100
Milton	7,475	44
Nahant	2,555	62
Quincy	27,135	89
Revere	13,165	60
Somerville	68,310	82
Stoneham	6,400	73
Swampscott	6,380	83
Watertown	10,950	49
Winthrop	7,485	89

Now those who were studying the subject in 1903 knew that even extravagant cities do not need to allow more than sixty gallons a day for each citizen. They also knew that the Metropolitan Water Works was supplying water at the rate of one hundred and twenty gallons a day for every man, woman, and child in the district. The question was where it all went; and on that hinged the next question, — how to save it.

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To find out, they kept two separate records: one showed how much water was used during the whole twenty-four hours; the other showed how much was used between one and four o'clock every morning. They knew that most people are asleep at that time, and that the water that was measured then was probably leaking and wasting. The tests were kept up for six months, and by the end of that time it was very plain that quantities of water were streaming away every night while the town was asleep. It was wasting so quietly out of sight that no one either heard or saw it.

But to be more exact about it, the men now chose the town of Milton for special investigation. This town has meters in every house, so that the committee knew not only how much water came to town, but exactly how much was used in the private houses and public houses, for street sprinkling and by the fire department. By comparing what was actually used with what went to town, they soon saw that there was an enormous waste. Indeed, it ended by their deciding that the huge street water pipes were leaking at the rate of three thousand gallons a day for every mile of street in Milton. Then they found the leaks, mended them at once, and saved quantities of water.

The water board of a town is supposed to keep the street pipes mended; but you and I, our fathers and our mothers are to blame if water goes to waste in our

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homes; for there are but two ways for it to escape, and we can discover them both:

1. Through broken pipes and fixtures that ought to be mended.

2. Through open fixtures that ought to be shut.

Although we may not always see the water leaking, we may often hear it wasting through a hidden valve that leaks in the bath room. The sound is a warning, and the valve should be mended.

It is a wonder how much can be wasted through a very small hole. A leak in a city pipe so small that a pin can stop it will let out water enough in twenty-four hours to give a family of five people a day's supply; and a hole that can be stopped by a lead pencil will waste enough in a day to give three hundred and sixty people all they need for twenty-four hours.

One of the surprising things that those Massachusetts water records show is that cities use more water in the coldest winter than in the hottest summer. The reason is that many people in winter keep a tiny stream of water running from their fixtures to keep the pipes from freezing. Thousands of these streams all over the city are enough to supply quite a river.

In January, 1904, there were two exceedingly cold days; and on each of those days the cities of the water district used sixty million more gallons of water than on any

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day in August of the same year. Notice this fact, however; cities that used the most water had no meters, while those that used the least had meters.

Malden and Chelsea have about the same population; but one has meters, the other has not. See the records side by side:

	Gallons per Capita August 4, 1904	Gallons per Capita Jan. 5, 1905
Malden (meter)	41	57
Chelsea (no meter)	88	211

In the list of eighteen cities for 1903 there are two interesting groups. The population of each is about sixty thousand, and each really needs about as much water as the other; yet here they stand with their different records. In each group the figures show the average number of gallons for each person each day:

First Group		Second Group	
Belmont	47	Chelsea	94
Malden	47	Medford	78
Milton	44	Melrose	100
Watertown	47	Winthrop	99

The first group uses meters, the second does not; and the lesson from those two rows of figures is that when water is measured and paid for by measure less is wasted. This is so true that a city always saves money by putting meters into its houses.

After that the occupants keep the fixtures shut; they mend leaking pipes; they compel landlords to protect

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pipes so well that they will not need to keep the water running to prevent freezing in winter. They do all this to save their pocketbooks, for no one cares to pay for what he does not use. Any broken pipe or open faucet that lets out water when it is not needed wastes it. Yet no water is wasted that is used for cooking, for drinking, or for keeping people and houses clean. In these ways we need to be generous with the water we use.

The one important argument against putting water meters into private homes is that when water is measured and payed for according to the amount used, economical families may be tempted to use less than they actually need; and when economy takes a form which sacrifices cleanliness, health itself is liable to suffer. For this reason, if a city can afford the expense of such waste as is sure to result when water is not metered, it will at least have the satisfaction of knowing that no member of its community is economizing on that which is so essential to cleanliness and to health as is the water supply of the home.

When we say that a city supplies water at the rate of so much per capita, we mean that each person's share is that amount. This includes all that is used in the city in every possible way and all that is wasted.

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CHAPTER XIII

DRINKING WATER

Two thousand years ago the Romans seemed to know that pure drinking water is more necessary for the health of a city than large houses, good laws, or clean streets. They learned this from experience, for at that

THE CLAUDIAN AQUEDUCT BUILT OVER 1800 YEARS AGO
It carried pure water to Rome from the Latin hills

time no one had ever dreamed of such things as disease microbes.

The Romans simply noticed that when they were crowded together in cities, and when they drank water from wells or brooks near which people lived, they were

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apt to suffer from certain diseases. They were so sure of this that, although the river Tiber ran through the very heart of Rome, they did not use it for drinking. Instead, they built enormous aqueducts that rested on arches and stretched across the country for scores of miles, carrying delicious mountain water to the city.

A Chinese River for Drinking Water

China manages in a different way. She takes whatever water is nearest at hand and uses it.

I am thinking just now of Tientsin on the Peiho River. The city is large and crowded with people. The streets are narrow and dirty, but they are washed sometimes when waste water and even sewage runs through them and sweeps the refuse into the river. On this

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same river thousands of Chinese junks lie anchored, or move from place to place with the families that live in them from one year's end to another; and everything that is disagreeable from all these boats and all these people is tossed overboard into the river.

Worse than that, on the banks of the Peiho, for hundreds of miles through the flat country, there are scores of other cities and villages, and each one throws all its refuse into the river to be carried to the sea. The water is yellow-brown at last, and wretched stuff for drinking. Yet hundreds of thousands of people in Tientsin, and in all the other crowded places on that crowded river bank, drink it every day of their lives.

Rome would not have dared to touch it. Still China is an old country too, and she has learned from experience just as Rome did, only she has learned two lessons instead of one:

1. Impure water is dangerous, — which the Romans knew.

2. Any human being can make the most impure water safe for drinking by boiling it for a few minutes.

They have learned these lessons so well in China that in every part of the country the people boil the water before they drink it. The rich and the poor, the wise and the foolish, all treat it in the same way. Most of them have a few tea leaves in the water, and they call

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their drink tea; but it often seems as if the tea were only an excuse for the boiling. After all, however, I doubt very much whether many of the people know why boiling makes it safe.

We ourselves learned in *Good Health* that boiling kills microbes, and that a dead microbe is no more dangerous than a dead wolf. We also know that it is quite as important to kill disease microbes that may be in our drinking water as to kill wild animals that may be ready to seize us.

Cities in America and England have been slow in learning either the Roman or the Chinese lessons, as the following London record of epidemics shows:

Epidemic of	Duration	Deaths from Cholera
1847	23 weeks	13,565
1854	23 "	10,684
1865	23 "	5,548

The special point to notice about these epidemics is that they all came from impure drinking water. Evidently the Englishman was drinking what the Chinese would have boiled and what the Romans would not have touched. In 1854, when people began to die by hundreds and by thousands, the doctors hunted for the reason and found that the center of the whole trouble seemed to be near Broad Street well. They noticed that those who used that water were far more apt to die of cholera than anybody else.

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Yet scores of men liked the water so much better than any other that they came from blocks around to drink it. They even brought pails and pitchers to carry it away in, for they said it was cool and clear and had a delicious taste; but at last so many were dying that the city officers warned the people not to use it. In spite of that fact, however, many kept up the practice until some one was sensible enough to take off the handle of the pump, which, of course, saved even the weak and foolish from being tempted.

Nobody knew why the water did such harm until one persistent man examined the sides of the well, and behold! there was the trouble. The bricks were so loose and the mortar between the stones was so useless that anything liquid could leak in. Later he found an old cesspool in a house near by, — indeed near enough to explain everything. Some one with cholera had evidently been in that house, and cholera germs had not only reached the cesspool but by leaking through had also reached the well and loaded the drinking water with disease microbes.

In the London epidemic of 1866 almost four thousand of those who died belonged to the same East District. When it appeared that all the water for this district came from the same source, the case looked suspicious and the city officers ordered a warning notice to be put up. Read it on the next page.

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CHOLERA NOTICE

The inhabitants of the district in which Cholera is prevailing are earnestly advised *not to drink any water which has not previously been boiled.*

After that those who followed the warning were safe. This example simply shows the serious side of the city-water trouble. People drink what they find, whether they draw it from well or faucet, for most of them know almost nothing about the difference between pure and impure water; and, in any case, the whole responsibility for the water supply seems to rest on the city government.

Still all citizens should learn a few facts by heart and practice accordingly. They should bear in mind the circle of the water history, — how it evaporates from ocean, lake, and river; and how it forms clouds, turns to rain, and falls to earth again. Then, too, they should know that although microbes are too small to be seen, they never evaporate with the water.

You may choose the brownest pool of water in the dustiest street in New York, but the vapor that the sun draws from that water is as pure and sweet as it is from any mountain spring. Disease microbes may be thick enough in the pool to give cholera or typhoid fever to one hundred men, but after the water has evaporated and after the vapor has turned to water again you and

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I may drink that water without the slightest danger from any sort of disease microbes that may have been in the pool. That is why rain water, direct from the sky through clean air and caught in clean pails, is always safe.

We must not forget, however, that rain water changes according to what comes in contact with it. First is the air. If this is full of dust and smoke, the earliest raindrops or snowflakes are not the clean ones, for they have washed the air and hold the dust themselves; but after the first sprinkle the water that follows is perfectly pure.

Nevertheless, if this pure water is caught in unclean reservoirs or polluted streams, it will be changed; or, still more serious, if microbes of typhoid fever, Asiatic cholera, or other diseases that attack the intestines can by any chance reach that water, every man, woman, and child who drinks it will be in danger.

It is well to know that in the United States the one water disease that we need to fear is typhoid fever, and that the only possible way for typhoid microbes to get into the water is from what passes out of the bodies of those who have the disease. For this reason the history of our drinking water after it reaches the ground may be a matter of life and death to us.

Though all water comes down in rain and either stays in lakes and rivers or soaks deep into the ground to

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supply wells and springs, still people speak of three kinds:

1. Rain water, or water caught and stored in reservoirs.

2. Surface water, or water in lakes, ponds, and rivers.

3. Ground water, or water from wells and springs.

When no bacteriologist examines our drinking water we have to trust to its history; that is, we have to know whether or not typhoid microbes have had any chance to find their way into it.

Rain water caught in well-made reservoirs is perfectly safe; ground water away from human dwellings is safe too, but surface water has to be looked after pretty carefully.

We must also remember that as freezing does not kill microbes, ice that has no respectable history behind it is as unsafe as the same sort of water would be; it should not be put into what we eat or drink. As a rule, on this account it is much safer to cool things by having ice near rather than in them. It is different, however, with manufactured ice, for this is generally made from distilled water. And when it has so creditable a history as that we may safely put it into what we eat and what we drink.

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CHAPTER XIV

GETTING WATER TO TOWN

It is a pity that the cities of Europe and America did not learn the Roman and the Chinese lesson long ago. Instead they have had some bitter experiences, one of which came to Plymouth, Pennsylvania, in 1885. The town had eight thousand inhabitants. Some of them took their drinking water from wells and springs, others used water from the Susquehanna River, while still others drew it from a beautiful stream that came down from the mountains and was stored in reservoirs above them. This water was so pure that those who used it felt perfectly safe until April, 1885. Then came typhoid fever, — one case at first, then five, fifteen, twenty, until within a few days the doctors had more than they could do. Fifty people were ill in one day; one hundred more the next day, and the numbers increased so fast that soon eleven hundred men, women, and children had the same disease, and one hundred and fourteen of them died of it.

In the meantime everybody was hunting for the cause. Some doctor then discovered that the only persons who had the fever were those who used water from the

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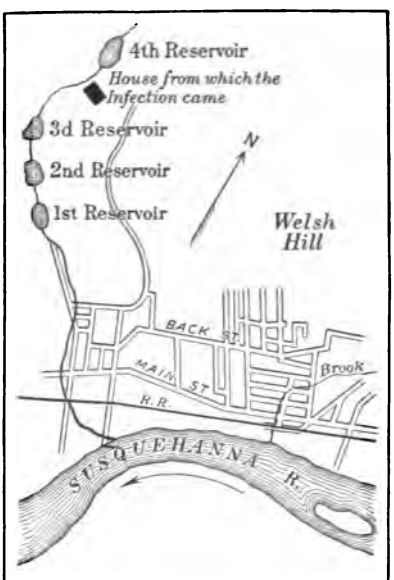
mountain stream, and men were sent at once to examine the banks and the reservoirs.

The road they took led them past the reservoirs one by one until they had nearly reached the last of the four; and here, beside the bank, was the house that caused all the trouble. Only two houses were anywhere near the stream, yet all the mischief came from one of them.



MAP OF PLYMOUTH, PENNSYLVANIA, IN 1885

It seems that through the winter a man had been ill there with typhoid fever, and that while he was ill his nurse had used the river bank as the emptying place for everything that passed from his body. The ground was frozen at the time, but we learned in *Good Health* that cold does not kill microbes. On the contrary, when spring came they thawed out with the snow, and trickled down the banks and into the stream with the melted ice; from there they reached the reservoirs and were carried to the people through the water pipes.

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In fact, there was no question about the history of that water, and it was easy to understand where all the illness came from. Every doctor knew that the microbes from one man had given the disease to eleven hundred other people.

Besides the illness and death in the city there was the expense of it. It cost Plymouth eight thousand dollars to maintain a hospital for the patients. In addition there was the loss of time and wages, with so many other expenses that it really cost the town over sixty-seven thousand dollars to have those microbes in her drinking water, — enough to have paid the salary of a man to watch the banks for many years. No wonder the loss taught a great lesson to the entire country.

To show why towns sometimes need to bring water from a distance and how they do it, take the case of Oberlin, Ohio, with its five thousand inhabitants.

Formerly many families in the place used well water for drinking, but as typhoid fever grew more common, and as houses were put closer together, a chemist was asked to look into the matter and see if the water was safe. He himself was surprised enough when he found sewage in almost every well. Yet this was perfectly natural, for, not knowing the danger, people often dug the well near the kitchen or the barn, with the outhouse not far away. It was convenient near by, and they thought there could certainly be no danger whatever so

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long as no one was ill in the house. But the history of Broad Street well, in London, shows what may happen in case illness does come. When, therefore, Oberlin knew the state of her own wells, and when she had decided to bring her drinking water from a safer place, she chose three men and told them to do three things.

1. To find water fit to drink.

2. To find enough to supply the whole town.

3. To plan to keep it pure from the time it left its source until it reached the homes of the people.

These men did their work faithfully. They examined the country for miles in every direction, traveled up the banks of every small stream, searched diligently for sparkling springs, and ended by choosing the springs that are the source of the east branch of the Vermilion River.

At a point six miles from Oberlin, they now bought one hundred and fifty acres of land, put a dam across the narrow stream, gathered all the water Oberlin needed, laid glazed pipes ten inches in diameter, and let the water run through them to the town.

In the meantime, in Oberlin itself, they bought ten acres of ground, had it scraped out for a reservoir sixteen feet deep and a quarter of a mile around, planted grass seed on the banks, let the ten-inch stream of Vermilion water pour into it, and soon had fifteen million gallons ready for use.

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Last of all came the engine house, pumps, standpipe, and filter, — so fine an outfit that to-day the small town of Oberlin has water as pure and safe as that of any city in the land. It is, in fact, as satisfactory as surface water can be made.

In some ways it is indeed much easier to manage the water supply in a small town than in a large one; and Cleveland, thirty miles from Oberlin, shows the

WATER IN STORAGE FOR THE CITIZENS OF OBERLIN

difference very well. Although now a large city on the shores of Lake Erie, still, years ago, Cleveland was a mere village with no question about drinking water, for the lake itself is eighty miles across, and neither steamers nor freight boats traveled on it then, as they do now, and the villages on its shore were few and small.

Naturally, therefore, Cleveland drank Lake Erie water fearlessly. More than that, not knowing the risk, — for no one suspected danger of that kind in those days, —

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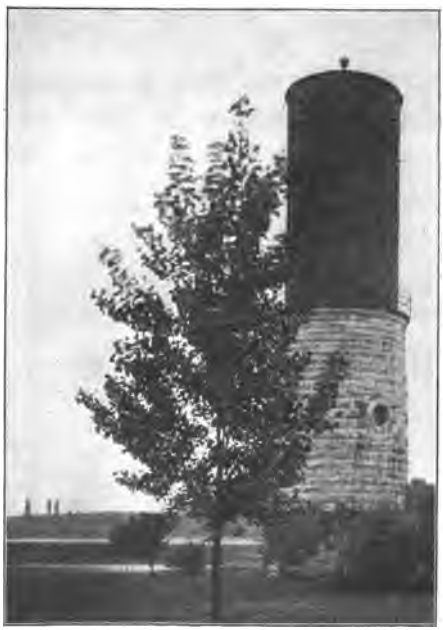
sewage also was poured into the lake. That explained all that followed, for the village soon grew to be a town, and the town to be a city. There were one thousand people in it, then one hundred thousand, two hundred thousand, four hundred thousand. At the same time, each year the city used more and more drinking water from Lake Erie and poured more and more sewage back into it; also, each year there was more typhoid fever everywhere in the city.



WATER IS PUMPED FROM THE RESERVOIRS INTO THE STANDPIPE, THEN SENT TO THE HOMES OF OBERLIN

Finally those who were intelligent about such matters began to suspect that city sewage was getting mixed with city drinking water, and they promptly boiled all they drank; but thousands of other citizens knew nothing about such things, and the fever accordingly spread so fast that soon hundreds had it and many died.

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By this time everybody was frightened. Some bought water by the bottle and by the gallon from men who brought it from the country to sell; others learned to boil it; while people who went to the city from the country to shop dared not take a drop of water from the time they left home in the morning until they reached home again at night.

The reason for all this is plain when we understand the exact situation.

Cleveland has two sets of underground pipes up and down all her streets. One set takes water to each house from a point in the lake which used to be about a mile and a quarter from the shore. The other set gathers up the sewage from the different houses in the city and empties it into the lake at different points along the shore.

Now those who understood the subject at the time said that if there were any chance to watch what was going on in the lake between the sewage pipes and the water pipes, everything would be explained. They were sure that the great stream of water which the pumps on land were drawing up into the water pipes also drew up some of the sewage from the sewer pipes.

An epidemic of typhoid fever came in 1903. Yet long before that the mayor of the city had asked special students of such subjects to come to Cleveland and give advice about the water and the sewage of the city.

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These men came. They examined the currents of water in the lake and the direction of the winds, also studying the water itself through a microscope. They then said that the city must make a change at once; that the water intake must be put ten miles from the sewage outlet; that one must be east of the city, the other west; and that the water must be taken from near the bottom of the lake, five miles from land.

Cleveland now discussed the matter thoroughly. All intelligent citizens knew that the expense of the changes would be enormous, but they also knew that impure water was a fearful thing to drink and they decided that the best water must be had at any cost. Contracts were therefore given, the work moved on steadily, and in 1904 the new intake nine feet in diameter was finished.

Almost at once doctors noticed a change in the typhoid situation. Fewer cases were reported and fewer died; indeed, after that, the death rate from typhoid fever decreased so fast from month to month that within a year even timid citizens felt safe again. Boiled water was not the rule any longer; spring water went begging for purchasers; hospitals were empty of typhoid patients; visitors from out of town drank the water without fear; and everywhere health and good cheer crowded typhoid fever and fear out of the houses, so much so that city health reports were pleasant reading again.

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One small set of figures comparing three months in 1904 with the same months in 1905 shows what the change really was.

DEATHS FROM TYPHOID BY THE MONTH

	February	March	April
1904	45	50	27
1905	2	5	7

Cleveland is so progressive, and does so much for the health of her citizens in every direction, that in the end she will probably decide either to send her drinking water through large sand filters, or to filter the sewage before it goes into the lake. This will be done because it is not perfectly certain that at some time winds and waves may not drive the sewage in the wrong direction.

For very many years Chicago had the same experience as Cleveland: that is, all the sewage of the city went into Lake Michigan and all the city drinking water came from the same lake. Each year, also, there was increasing typhoid fever until at last, in desperation, Chicago voted to spend forty-three million dollars in improving her drinking water.

By digging a canal twenty-eight miles long, the sewage of the city was now turned away from the lake, and, mixed with a great volume of lake water, it streamed from one river into another until it entered the Mississippi and flowed on to the Gulf of Mexico.

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Immediately after that there was a change in the city death record. Instead of sixteen deaths for each thousand of the people each year, the number dropped to fourteen deaths for the same number of people. This meant the saving of hundreds of lives every year.

In the meantime, however, three hundred and fifty miles away, the citizens of St. Louis were drinking Mississippi River water as they had always done. The next chapter will give us a notion as to what they thought of the Chicago scheme for getting rid of sewage.

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CHAPTER XV

RIVERS, DRINKING WATER, AND SEWAGE

When St. Louis realized that the entire stream of Chicago sewage was being emptied into her own water supply there was great indignation in the city. Not only so, but in 1900 a famous lawsuit was begun in behalf of St. Louis, called "The Chicago Drainage Canal Case." Through this lawsuit the state of Missouri tried to compel the state of Illinois to prevent Chicago from sending sewage onward to the Mississippi River. The defense argued that so much lake water went on with the sewage that the liquid which reached St. Louis from Chicago was purer than that which the Missouri River poured into the Mississippi above St. Louis. They also said that after typhoid microbes from Chicago had spent ten or twenty days in getting to St. Louis they were probably dead. This could not be proved, but every scientist granted that the distance greatly reduced the danger.

The case was tried before the Supreme Court of the United States. Expert scientists were engaged on both sides; every city in the land was interested, and, after about six years of investigation and discussion, the court gave its decision in favor of Chicago.

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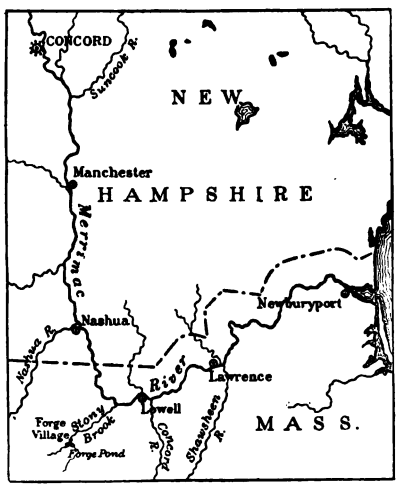
In multitudes of cases, however, cities on the same river are but a few miles apart, and then it is that the water and the sewage problems become very serious. A remarkable example of this used to be that of the Merrimac River in Massachusetts.



A River that carried Disease from City to City

Turn to a map of New England and you will see how this river runs through New Hampshire and Massachusetts and empties into the Atlantic Ocean. You will also notice that, besides all sorts of smaller towns, there are seven good-sized cities on its banks,—Concord, Manchester, Nashua, Lowell, Lawrence, Haverhill, and Newburyport.

The history of the drinking water in these cities is especially interesting because it shows how it has been connected with typhoid fever over and over again.

Each city started with a few families. These increased until each group became a village. Each village then grew until it was a city, and most of the families in most of the cities always took their drinking water from the river and poured their sewage back into it. At first

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pails and buckets were used to dip up the water and carry it to the houses, but in time the cities put in two sets of pipes, — one for water, the other for sewage.

This arrangement continued unchanged for years, though finally some of the cities grew suspicious and took their drinking water from elsewhere. But there was no change about the sewage; by day and by night all the streams that emptied into the Merrimac River, and all the cities that stood on its banks, poured their sewage into it.

Of course the farther downstream a city stood the more sewage it received from other places. In fact, the only houses that were perfectly safe in that whole region were those that were so near the sources of the river itself, or of its little branches, that no other people lived above them.

Cleveland spoiled her own drinking water with her own sewage, but on the Merrimac River each city was spoiling the water for every family below it.

This was done innocently, of course, for long ago, when people knew nothing about microbes, they judged water by its color, its taste, and its odor. If it had no odor, looked pure, and tasted sweet, it was considered perfectly safe for drinking.

Even later than that, when scientists knew about microbes, they believed that no matter how much sewage a city poured into a river, if the river itself was of good

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size, and if the nearest city downstream was several miles away, the water would be free from disease by the time it reached there. Somehow they thought that moving water purified itself, and they knew that the size of a river always made a difference.

Now it is indeed true that the larger the river, and the farther off the next city, the safer the people are when they use the water. This is partly because the more water sewage mixes with the more dilute it will be, and the farther apart the microbes will be scattered. That, in turn, means that the more dilute the sewage the less danger there is to those who drink it.

Then, too, some microbes do certainly die on the way downstream, so that distance is a great help; but when we think of that one man ill with typhoid fever above Plymouth, and of all the people who died, we realize that even very dilute typhoid sewage is perilous stuff to drink.

In former times, however, the Merrimac River people were so sure that their river had purified itself by moving, that even while they were dying of the fever they kept on drinking unboiled river water. At least this was the case with Lowell and Lawrence.

To make the matter more tragic, the list of deaths for each year for each separate city shows that during every year from 1889 to 1893 Lowell had more typhoid deaths than Concord, Manchester, or Nashua, and that

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Lawrence had a much longer death list than Lowell. Look at the map again and you will find the explanation of both facts. Lowell is farther downstream than Concord, Manchester, and Nashua, while Lawrence stands below Lowell.

Indeed, the two places are only nine miles apart, and both receive drinking water mixed with sewage from all the other cities, but Lawrence gets an extra quantity because all the sewage from Lowell, with a population of eighty-five thousand, flows on in her direction.

In 1893 Newburyport had a sad experience. This city is below Lawrence, and, as a rule, brings water from large, pure springs at a distance from the river. But in January of that year about thirty people in different parts of the city had typhoid fever at about the same time. This was astonishing, and there was a good deal of investigation. Then it appeared that the springs had not been giving enough water to supply the entire city, and, to piece out, some one had turned Merrimac River water into the pipes. This had been going on for some time, and no harm came of it until typhoid fever broke out in Lawrence. Shortly after the same trouble reached Newburyport, and no one doubted that the microbes had traveled down by water from Lawrence.

An example like this simply shows how disease in one city may destroy life in another.

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For several years Lawrence had over three times as many deaths from typhoid fever, for the size of the city, as Cambridge, Worcester, or Lynn. When we notice that the cities which escaped did not use Merrimac River water, we understand the case at once.

The truth is that, even in 1890, intelligent men and women were ignorant or careless about the history of their drinking water. As for typhoid fever in Lawrence, so many died every year of that disease that people fell into the habit of thinking that it belonged to the place, that it came in the air, or in some other mysterious way; they were slow in putting the responsibility on the shoulders of the microbes from other cities.

Finally, however, those who watched noticed that there was something remarkable in the way the fever came. They realized that whenever Lowell had it Lawrence followed with a worse attack, and that when Lowell had no fever Lawrence was apt to have none.

Mr. H. F. Mills, a member of the State Board of Health, had already called attention to the matter, and he said that the cause was probably impure water. In 1890 the epidemic was so serious in Lowell that Professor William T. Sedgwick, who was at that time the biologist of the State Board of Health, was asked to study the case thoroughly; while the water board of Lowell also asked him to tell them how to avoid such epidemics in the future.

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Professor Sedgwick and his assistants went to work at once. The first thing they did was to find out whether any one had had typhoid fever in that region before the real epidemic began. It then appeared that on the banks of a small stream called Stony Brook there had been several cases of the fever. The sewage from these people had gone into the brook, the brook had emptied into the Merrimac River, and two miles below were the intake water pipes for Lowell. Surely the road the microbes had traveled was as plain as in the Plymouth case; through the brook and the river they reached the pipes, and from the pipes the people drank them.

That was the first chapter of the epidemic. The second followed about two weeks later, when the same disease appeared in Lawrence. As we understand the matter in these days, we see that the epidemic was bound to reach Lawrence, because by this time all the sewage from the hundreds of people who were ill in Lowell was hurrying down those nine miles by river to Lawrence, and every day thousands of people were innocently drinking it with the water.

The more the state board of health studied the subject the more interested they became. By this time they had given up the notion that running water purifies itself; they were also sure that the danger was from microbes in the sewage, not from the sewage itself, and that those microbes were not killed by traveling downstream.

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They saw that Lowell and Lawrence always had sewage in their drinking water, but that they only had typhoid fever when there was typhoid fever in the cities above them. They also saw that there was no possible way to tell by the color or the taste or the general looks of any water whether there were disease microbes in it or not, and they promptly decided that the only way to be safe was to be rid of every possible microbe and drink only the purest water.

TYPHOID MICROBES

To study the *flagella* on them see *Good Health*, page 30

Now this was more easily said than done, for the question was how to get the purest water for every city. There was Cleveland, for example, who gave herself typhoid fever by carrying her own microbes round and round in a circle through her drinking water and her sewage. Then there was Lawrence that took typhoid microbes from other cities. Yet Cleveland must keep on using lake water, and Lawrence must take hers from a river. What they needed was some way of changing the character of the water in both places. The question was how to do it.

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CHAPTER XVI

PURIFICATION OF WATER AND SEWAGE

The State Board of Health now advised Lawrence to put in large out-of-door filters, as London and Berlin had done.

They said it was the only thing to do. Indeed, they knew from experiments which they themselves had made just how helpful such filters may be. This settled the case for Lawrence.

The city now borrowed thousands of dollars, engaged many workmen, accepted plans which Mr. Mills had made free of charge, and proceeded to make huge sand filters which covered two and a half acres of ground.

As the work went on everybody was interested. It certainly did not look as if such filters could do any particular good, for they were made simply of layers of gravel and of coarse and fine sand, with pipes underneath. The water was to go from the river to the surface of the filters, and from there it was to soak through the sand and be carried in pipes to all parts of the city.

After about one year of work the filters were ready, and before using them bacteriologists examined a sample of the water in the laboratory, just as they always do

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in such cases, and found millions of microbes in every spoonful of it. This showed how much it needed to be purified, but no one except a scientist could have any idea how the microbes would be taken out of the water. Nevertheless, after several months even unscientific persons began to understand the wonderful work which was being done. They saw river water with its load of microbes before it went on the filters; they also saw it after it came from the pipes underneath, and they believed the bacteriologists who told them that this water was now almost as free from microbes as a mountain stream. But still they wondered if the filters would continue to do good work year after year.

The answer came two years after they were finished. Lowell suffered from another epidemic; one hundred and seventy-four people were ill; and Lawrence, remembering that every typhoid epidemic in Lowell used to mean a worse siege yet for herself, waited anxiously. This time, however, she escaped. In fact, her filters now worked so well from one year's end to another that only one fifth as many people died from typhoid fever each year. That means that the citizens of Lawrence are now five times as safe from typhoid fever as they used to be.

No wonder the city believes in filters. No wonder the whole country has learned a lesson.

Lawrence used to be such an unhealthful place that people dreaded to live there. To-day it is one of the

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most healthful cities in Massachusetts, and both the citizens and the world know that sand filters have done more for the health of Lawrence than anything else the city has ever paid for. When they were put in there were but two others of the kind in America. Now, however, from one end of the country to the other, cities are making them as fast as their citizens understand how much they need them.

In some places a mechanical filter, as it is called, does much the same work in a different way; that is, it clears out multitudes of microbes. These filters are also widely used. The truth is that intelligent citizens everywhere are beginning to see that a good filter means more for the protection of life and health than doctors and car loads of medicine.

Even so long ago as 1885 the legislature of the state of Massachusetts decided that the Board of Health should give advice to the towns and cities of the state in all questions of water and sewage; and, in order that this might be done wisely, the Board examined every river, lake, and pond in the state, and knew just how safe and just how unsafe the water was in the different towns and cities.

Massachusetts has also ordered that no town or city shall supply itself with water, or put in a sewage system, without showing the plans to the State Board of Health. Thus she is able to protect the water rights of each family, town, and city in the state.

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She can do this wisely because she has studied the sewage as well as the water question.

The great sand filters of Lawrence are intended for nothing more than to purify the river water, and in this they succeed. But the state has done even more than that. She has established what is called an experiment station and here, for years, she has been trying to discover some way by which cities may get rid of their own sewage without ruining the drinking water of neighboring cities. The station is in Lawrence.

These experiments began in 1887, and are still going on. Through them scientists in Massachusetts have learned more about purifying sewage than has ever been known before. They have made sewage filters of every sort and tested them faithfully. Each separate sewage filter is like a long barrel; some large, and some small; they all stand in the experiment station, and from the experiments that scientific experts have made by running sewage through those filters, they have discovered many important facts.

They have learned how to change the worst sort of sewage into clear and sparkling water. They have learned that no matter how any sewage looks or smells when it is poured upon a good sand filter, and no matter how many millions of microbes there may be in every thimbleful of it, still after it has soaked through the filter and run off through the drainpipes underneath

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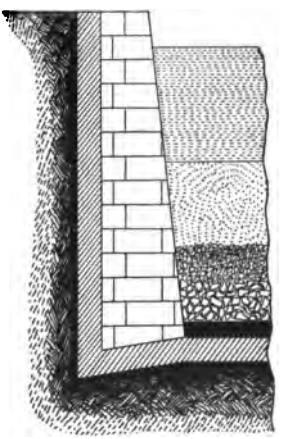
ninety-nine out of every hundred of these microbes will have vanished.

They have found that they can make filtered sewage as safe to drink as the well water of Lawrence. This has surprised the world. No one knows precisely how the work is done, but it is plain that somewhere between the top of the filter and the bottom most of the swarming microbes have been killed and taken out of the way. And now, from different parts of the world, scientific men as well as other people go to see the curious sight, — a filter with yellow, disagreeable sewage on top and a stream of clear, pure water running out below. It looks like magic, but those who use the filter are willing to tell the secret. They say that sewage filters are made very much like those for water. First of all are the drainpipes. Above these is a layer of the smallest stones; next, a layer of coarse sand, and on top a layer of very fine sand. The whole together makes a bed four or five feet thick. This is the whole scheme. Certainly it is a simple machine to do such marvelous work. Nevertheless, within this machine, living on each grain of sand, is the innermost secret of the sand filter.



SAND FILTER
From coarse gravel to fine sand

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We all know that certain creatures spend most of their time underground, — as the angleworm does, and the mole. Yet besides these, on every inch of ground, there are millions and millions of smaller creatures that we cannot see.

Some of them drift here and there with the dust in the air; but most of them never leave the earth; it is their home, and I suppose there are more of these microbes on every foot of ground to-day than there are human beings on the earth.

Many people act as if they considered all microbes dangerous. On the contrary, however, many of them are the best friends we have. We can only see them with the microscope, but they are as truly alive as you and I, and, to keep alive, those that help us in our filters need oxygen, moisture, and food. This explains the way they purify our water and sewage, for on each grain of sand in every good sand filter thousands of these friendly microbes live and multiply. They are especially thick on the surface of a filter, and it is just there that the most important work is done.

Moreover, they are a hungry host, and they find the very best food for themselves in the worst kind of sewage.

When the dreadful stuff is poured on a filter it is allowed to soak through slowly; in fact, men have noticed that the more slowly it goes the purer it gets.

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The reason is that the microbes do better work when they have time to take every impure thing out of the sewage. In doing this, as it turns out, they also destroy the disease microbes that were in the water. Thus we see that by feeding one set of microbes we have killed the other set. In some way our friends have killed our enemies and we are safe.

This is the whole secret of the success of the sand filter. It is the friendly microbes on the sand that purify the water and save us from disease microbes.

In all this, sewage filters and water filters are alike, but there is an important difference in the way they are used. Those microbes on the sand need oxygen as well as food. They will die without it, and it seems that water holds so much oxygen that the microbes get what they need out of it. Accordingly a water filter may be kept at work continuously. For this reason it is called a continuous filter.

Sewage, on the other hand, holds so little oxygen that when the microbes on the sand are covered by it they are in danger of being suffocated. In other words, the cleaner the liquid which is poured over them, the more oxygen the microbes get from it, while the worse the liquid, the less oxygen there is for the microbes to use. Sewage, therefore, needs an intermittent filter, and its name shows just what happens and why it succeeds. Sewage is poured on a filter until it is a few inches deep all

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over the top. This soaks slowly through and runs off. Another flood is then poured on, and this is done once or twice every day. When sewage is filtered in that way it is always purified, because the microbes have had a chance to get oxygen out of the air between each flood of sewage; that is, because they could get air they have kept alive and busy.

It is quite the other way if sewage is left on a filter all the time for weeks together. In such a case the sand microbes get no air, and they are sure to die. When that has happened the sewage microbes go safely through from top to bottom of the filter and escape in the water that runs from the drains underneath. By their escape we therefore know that their enemies, the sand microbes, are dead. Perhaps we might really say that they have been drowned, for what they needed was air, and they could not get it.

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CHAPTER XVII

PREVENTABLE DISEASE AND THE JAPANESE ARMY

Of every hundred soldiers who died in the Spanish-American war during 1898 twenty were killed by bullets and eighty by microbes.

The war was soon over, lasting but four months; still it was long enough to show that the government of the United States had not acted according to its knowledge of disease microbes. It had allowed four times as many men to die needlessly, in camp and tent, away from even the sound of cannon and gun, as fell fighting in the cause they were willing to die for.

Up to that time any other soldiers fighting in any other country would have met the same fate, for all previous wars had had the same death record. At last, however, came the Russo-Japanese struggle of 1902. Japan knew that defeat for her meant a ruined empire. She also realized that, according to the law of numbers, she and her forty-eight million people would surely go under in the fight against Russia and her one hundred and twenty-eight million. Nevertheless, she proposed to win, and one of the officers explained to Major Seaman how they planned to do it.

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"Russia may be able to place two million men in the field," he said; "we can furnish five hundred thousand. You know in every war four men die of disease for every one who falls from bullets. That will be the position of Russia in this war. We propose to eliminate disease as a factor. Every man who dies in our army must fall on the field of battle. In this way we shall neutralize the superiority of Russian numbers and stand on a comparatively equal footing."

In other words, it was as if Japan had said, "Our soldiers will not be allowed to die of preventable diseases."

After that those soldiers were the wonder of the world. Hundreds of thousands of men went into the campaign. They traveled by rail, by steamer, and by transport; they crossed the Corean Straits and the Yellow Sea into Corea and China; they marched across hundreds of miles of country where water was not safe to drink; they bought food from people who were ready to sell what was not safe to eat; they entered towns where men and women were dying of contagious disease; they were also wounded in battle like other soldiers; but, from first to last they were strong for the march, healthy in camp and on the battlefield, and more free from diseases than any soldiers who ever went to war before.

This was so extraordinary that doctors and army officers all over the world were eager for an explanation. They wanted to know what it was that kept hot, thirsty

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men from drinking typhoid microbes from polluted wells and unclean streams as they marched; also, why it was that hungry soldiers did not eat half-ripe fruit and unwholesome food on their journey, and how it happened that when they reached a town they were able to escape contagious disease from the houses and the beds of those who had died from smallpox, scarlet fever, and the like.

A JAPANESE SOLDIER
He fights both man and microbe

In answer to all this the Japanese made no secret of what they did. They acknowledged that they had first learned about disease microbes from scientific men of other nations, and said that they had simply put their knowledge into practice.

This was evidently the case. The government had decided that instead of waiting for some epidemic to show which water, or food, or town was safe and which

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unsafe, it would find out the actual condition of things before the soldiers had any chance to risk their lives. It claimed that the best scheme was to fight the microbes, or at least to find out where they were and how to dodge them, before the soldiers were allowed to fight the Russians.

That then was the secret of Japanese health and success.

To carry out the plan, instead of keeping all the doctors with the army to cure the men after they were ill, some were sent on ahead with the scouts.

"Doctors belong in the front," they said, "not in the rear."

So they traveled in front and certainly found enough to do; for, whenever they reached a town, every well, stream, or spring of water, though it was sparkling and cool and as clear as crystal, was examined with the utmost care. Those Japanese scientists knew that thirsty soldiers sometimes act as if they were willing to forget all they knew about water dangers and drink almost anything wet; while at the same time they also knew that a great thirst is safer than unknown water from polluted streams.

With this in mind water examinations were thorough, and the doctors posted up notices accordingly. These notices were very definite. Sometimes they said, "This water is good"; again it would be, "This water is bad,"

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or " This water should not be used unless it is boiled for half an hour." When the army arrived soon afterward each man was ready to heed the posters.

So it was in other directions. When troops of men went off on a foraging expedition a doctor always went with them. He tested the different kinds of fruit, meat, and vegetables which the natives wished to sell; and if the fruit was too ripe or the meat too old or diseased, he put up a notice saying so. No one touched it after that.

When this same health delegation reached any town through which the soldiers must pass, it examined the condition of the houses, and if contagious diseases were found, that part of the town was quarantined; that is, no soldier was allowed to go into it on any account, or, if this could not be managed, the entire army marched on to another place. Again also it was a signboard that told the men what to do.

Not only did the government try by every method to keep the army in good fighting trim, but other doctors stayed in camp to give hygiene lectures to the soldiers. They talked about eating and told the men what was safest to use; they talked about drinking and told them why boiling was the only way to make unknown water safe; they discussed contagious disease and explained how it traveled from man to man; in fact, in every possible way they made it plain that, as a rule, what the

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men ate and what they drank would decide whether they would be well or ill, whether they would live or die.

They went even further than this, for they talked about bathing to keep the pores of the skin open, and about soiled finger nails that go loaded with microbes. More than that, on the war ships the command was that before every engagement the men should bathe and put on clean underwear. It seems that the surgeons had noticed that when a piece of broken shell crowds soiled linen into a wound, it turns out to be a more dangerous affair than when the linen is clean.

Thus one command followed another. Evidently the government thought that when a man had given up his home and was ready to die for his country, he deserved the best advice, the best care, and the best food his country could give him.

The soldiers in turn wished to be healthy, and therefore followed directions. What was the result?

Major Seaman, from whom we learn most of these facts, says that when he visited the military hospital in Tokyo he found that over one thousand wounded men had already been received and that not one had died, while all who were still in the hospital looked as if they would recover. The same was true of other reports from other hospitals.

Early in the war 6636 men had been wounded and taken to the reserve hospital at Hiroshima; yet up to

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August first only thirty-four of this great number had died, although some may, of course, have died later. This astonished surgeons in every other land.

Then there was the hospital ship *Hakuai Maru*. In seven trips she took over two thousand wounded men across from China to Japan, and not one of them died on the way.

Never in any war has there been such a record of healed wounds. Part of the credit belongs to the vigorous health of the wounded men, and part to the skilled doctors and nurses.

When the war was over, — when Japan had been victorious in every great battle and had saved her empire, — she made out her reports. Then it was that the nations of the world learned their lesson, and saw how they too might save their patriots in time of war and increase the number of their living heroes.

The entire campaign lasted over eighteen months, and during that time 72,450 Japanese soldiers lost their lives. Of these over 57,000 died either on the battlefield or from the after effects of their wounds while only 15,300 died of disease.

Compare these figures with the old-fashioned war records and see how the Japanese turned things topsy-turvy. Instead of losing four times as many soldiers by preventable disease as by bullets, Japan actually lost less than one fourth as many in that useless way. In

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doing this she won as great a victory over the microbe as over the Russian.

What Japan did for her soldiers cities are gradually learning to do for their citizens, and the chapters of this book are intended to help in this respect. We all need to know that it is much easier, much more economical, and much more important to keep people from taking disease than it is to cure them after they have it. We need to know that prevention saves many times as many lives as medicine ever cured, and we need to know what particular prevention will save us from what particular disease.

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CHAPTER XVIII

TOBACCO AND NATIONAL VIGOR

Japan knows that a race of weak boys can never turn itself into a race of strong men. She is also determined that the small size of her men shall make no difference in her power as a nation or in the number of her heroes. To make sure of this she tries to protect her boys from whatever may weaken them in body or mind. This explains the remarkable proclamation of the Emperor of Japan in March, 1900. But before telling about that, another bit of history will show how America helped Japan along.

Several years ago Professor Seaver, of Yale University, decided to do what he could to discover whether the use of tobacco has any special effect on growing boys. He was director of the Yale gymnasium, and for nine years, until 1897, he weighed and measured all the students who entered the university. He not only measured them in height, in chest girth, and in weight, but he also asked the age of each, and, most important of all, he asked whether they had smoked before coming to college.

The answer to each question was carefully written down and kept as a record. At the end of the nine

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years, when Dr. Seaver studied and compared these student records, he made several important discoveries. First of all he saw that, as a rule, the smokers who had entered Yale during that time were about fifteen months older than the non-smokers. This seemed to prove that the minds of the boys who smoked did not work so well as the minds of those who did not smoke, which, of course, explained their being older when they entered college.

As for the size of their lungs, it appeared that those of the average non-smoker could hold about five cubic inches more air than the lungs of the smoker; moreover, and quite as fortunate for themselves, the average height of the non-smokers was about one third of an inch more than that of the smokers. This was especially surprising, for, as we have seen, they were younger and ought naturally to have averaged a trifle shorter.

As these measurements and comparisons went on various people were getting interested. Naturally, of course, non-smokers were rather elated, while the smokers were surprised and disgusted. But the next point was to examine the men who were already in the university. They were divided into three groups:

1. Those who never used tobacco.
2. Those who had used it for a year at least.
3. Those who used it irregularly.

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The records now showed how much more the non-smokers grew than the smokers while they were in college. The non-smoking group gained:

In weight { 10.4 per cent more than those who had smoked a year.
6.6 per cent more than those who had smoked irregularly.

In height { 24 per cent more than those who had smoked a year.
11 per cent more than those who had smoked irregularly.

In girth of chest { 26.7 per cent more than those who had smoked a year.
22 per cent more than those who had smoked irregularly.

In lung capacity { 77 per cent more than those who had smoked a year.
49 per cent more than those who had smoked irregularly.

Yet, after all, the mind counts most in any great university, and if the smoker could prove that even though his body had lost in height and size, his mind had gained so much the more in keenness, why of course the tables would be turned again, and he could do some exulting. Dr. Seaver, therefore, looked into the scholarship of the two sets of men, and found that out of every hundred of those who took the highest rank only five were smokers, while ninety-five were not smokers; but among the rest of the students sixty out of every hundred smoked.

When the Japanese heard all this they gave heed. But before going into the subject we should remember that every boy in Japan used to smoke and that many girls smoked too. We should also remember that Japanese tobacco is not very strong, and not so harmful as

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ours. Yet in spite of this, several years after Dr. Seaver's experiments, a set of Japanese men decided that the wealth, the intelligence, and the fighting power of the nation would be increased if the children could be kept from smoking. The result was that in December, 1899, the House of Representatives in Tokyo discussed the matter with a good deal of excitement; the subject of discussion being called, "A Bill for prohibiting the smoking of Tobacco by Young Persons."

All those who supported this bill used America and Germany as the great arguments. They said that in Germany youths under sixteen were forbidden to smoke lest they should become unfit for soldiers. They also said that in America, at the time of the war with Spain, hundreds of young men were refused by the doctors because they were not vigorous enough to be soldiers, and that ninety out of every hundred of them were smokers. They spoke of Dr. Seaver's work at Yale, and said that both in the military academy at West Point and in the naval academy at Annapolis the United States government does not allow any smoking whatever.

All this was quite convincing, especially when one man added: "If we expect to make this nation superior to the nations of Europe and America, we must not allow our youths in common schools, who are to become the fathers and mothers of our country in the near future, to smoke. If we desire to cause the light of the nation

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to shine forth over the world, we ought not to follow the example of China and India."

Another man said, "When I see useful young men, with their school uniforms on, smoking, I feel very sad and often I say to myself, 'How can they accomplish great things when they are slaves to tobacco?'" Indeed, everybody seems to have had the same notion about the importance of the bill. Mr. Omura said:

In 1876 I received treatment from Dr. Takagi in the Tokyo hospital, who made an incision in my face, as you see, because I was in a hopeless state from tobacco poison. At that time, as I heard afterwards, all gave up hope for me, and my relatives discussed the methods of carrying my body back to its last home. But here I am, well and strong. Thus from my own experience I know that tobacco is a bad thing; hence I should like to see it prohibited altogether, if it be possible. I began to smoke at nine, and at twenty-four or twenty-five the habit had become simply fearful. I spent much money not only for tobacco itself but also for smoking materials. Several times I fell down unconscious on the floor. Such was my fondness for tobacco. But twenty years have passed since I gave it up entirely, and I have gradually become stronger, and at present am a little stronger than Mr. Inouye. . . . If one smokes, whether he is young or thirty years of age, whether a student in a university or in a post-graduate class, he will be poisoned; hence I favor the idea of prohibiting smoking altogether among students.

Later some one said:

As to schools and scholars, we pay taxes and bear heavy expenses for their support, and we watch with deepest interest the success of every scholar. And yet, if the weight of their bodies decreases, the

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lung capacity lessens, and finally the scholars themselves become diseased because of no proper protection against smoking tobacco, then the taxes paid by the people at great sacrifice will become fruitless. I earnestly entreat you to reconsider the question of putting special restriction upon students.

After full discussion the bill was changed a little, and on December 19, 1899, was adopted by the House of Representatives. Two months later the same bill was discussed in the House of Peers. The great question was whether it would be defeated there, just as our Senate at Washington often defeats bills passed by the House of Representatives. Yet the outlook was favorable from the start. Among others Mr. S. Izawa spoke. He said:

I too wish to say a word in support of this excellent bill. . . . A few days ago some one sent us some printed matter. What was written thereon? It was written that should this bill become a law of the nation, there would be a loss of yen 200,000 to the National Treasury. Nonsense! He is a traitor. He is willing to sacrifice the character of our youths simply for yen 200,000. What wickedness! Such a person would most surely try to urge the use of opium by and by. As there are such traitors, this bill must by all means be carried unanimously, and thus the honor and wisdom of this House will be vindicated before the public.

Mr. T. Obata said:

I cannot agree with Messrs. Murata and Izawa. I admit that tobacco is injurious to young persons, but parents themselves should be able to stop its use. . . . Should our children be caught by the police on the streets because of smoking tobacco, this very fact is more of a disgrace to our children than smoking itself.

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At this point Mr. J. Kodama sprang to his feet and said:

I wanted to keep silence, but as I heard the gentleman speaking against this bill, I felt I must say a few words in its favor. I heard from an American gentleman that in his country a large number of volunteers for the army service were rejected on account of the weakness of their hearts, and the chief reason assigned for this defect was their habitual use of tobacco. I do not need to say any more from the educational standpoint, but if our youths are to become unfit for military service by the use of tobacco, it is alarming. By all means, let us stop the use of tobacco by young persons.

Thus the discussion went on until the whole House of Peers seemed to come to the same conclusion; for after they had voted on the bill the president of the House said: "Since there is no objection, the original bill stands approved."

On the sixth day of March, 1900, by proclamation of the Emperor of Japan, the bill became the law of the land. The words of the prohibition are, "The smoking of tobacco by minors under the age of twenty is prohibited."

Penalties are attached, and the law went into effect on the first day of April, 1900.

Though Japan has done more than any other government in this direction, still she learned her lesson from America; and we are becoming more and more sensible in the matter of putting our own knowledge into practice. Our government led the way in her military schools, but our athletes are following close behind; in fact,

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they are so strict that it almost looks as if they did the leading. Throughout the country the captains and trainers of the best of our football, baseball, and basket-ball teams, of the best boat crews and athletic meets, are united against the use of tobacco by their men. Many of them prohibit it absolutely. The reason is that they wish their men to win, and they are sure, just as the Japanese are, that tobacco will be a hindrance to them. They say it puts the body machine out of order.

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CHAPTER XIX

FOOD INSPECTION

Springfield, Massachusetts, had no question about her epidemic in 1882, nor about the cause of it. The drainage was good and the houses clean and healthful; yet the epidemic was typhoid fever, and neither the doctors nor the health department could tell where it came from. They then asked the state board of health to lend a hand.

This ended with the discovery that each person who was ill used milk from the same milkman, that the milkman bought all he had from a certain farmer in the country, and that a man in the farmer's family had just had typhoid fever. Even yet, however, there was a mystery, for how did the microbes from the body of that particular man ever reach the milk? No one could answer the question, for no one knew. Perhaps the cans had been washed in water that held the microbes; perhaps the microbes were on the hands of the man who did the milking; perhaps some one had put contaminated water into the cans to increase the milk supply. In one way or another the microbes had certainly reached the milk, for the epidemic proved it.

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Springfield does not stand alone in this sort of calamity; indeed, a few years ago a medical journal gave a list of three hundred and thirty outbreaks of epidemic disease that started from microbes in milk. One hundred and forty-seven of these cases were typhoid fever, while most of the others were scarlet fever and diphtheria.

It is not disease microbes alone that damage milk, for a second great mischief is done when too many microbes of even the harmless kind are in it. Ninety-two New York babies once taught the board of health a lesson on this subject. It happened during the summers of 1902–1903, and various doctors watched the case. Fifty-one of the babies were using milk just as the city milkman brought it, while forty-one received what is called pasteurized milk, that is, milk that has not been boiled but has been heated long enough to kill the microbes.

Kinds of Milk and Number of Microbes	Number of Babies	Well all Summer	Quite Ill	Average Weekly Gain in Weight	Average Number of Days of Diarrhea	Deaths
Pasteurized . . . 1000 to 50,000 per cubic centimeter	41	31	10	4 oz.	3.9	1
Raw Milk . . . 1,200,000 to 10,000,000 per cubic centimeter	51	17	34	3.5 oz.	11.5	2

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The point to discover was which milk was best for every kind of baby. After the records were kept and the preceding table made out no one had any doubts on the subject. One cubic centimeter stands for about twenty drops.

While the doctors were studying the case thirteen of the babies who used raw milk were so sick that they were changed over to the heated milk diet; indeed, unless this had been done, the chances are that some of them would have died and increased the raw-milk death list. Yet, in a matter of that kind, no one dares to go far enough to see how many babies will really die, for they are far too precious to be risked.

Nevertheless, the experiment proved very clearly that babies who use pasteurized milk are much more likely to live and less likely to be ill than other babies.

Of course, milk without microbes in it at the start would have been even better for the babies than milk in which the microbes had been killed; but the trouble is that impure milk never tells any tales about itself, for it looks as pure and sweet as the purest milk in the market. Between the epidemics and the babies, however, we see that microbes may damage milk in two definite ways:

1. By being carriers of disease.
2. By being too numerous, although they may not be disease microbes.

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Springfield suffered from the disease carriers, while the fifty-one New York babies suffered from the number of the microbes. To explain how mere numbers could harm them, we must know that milk is as good a food for microbes as for babies, and that they multiply so fast in it that, if it is not cold, one microbe will become two hundred in three hours, ten thousand in six hours, ten million in nine hours, and so on.

We see then that if a few are in it when it leaves the cow in the country, there may be countless millions of them by the time it reaches the baby in the city.

Now there is just one special objection to these multitudes of microbes that are harmless in themselves, and that is the change they make in the milk while they are multiplying in it. The truth is that even harmless microbes damage milk in this way, and the more microbes the more harm. When, therefore, the numbers increase by the hundred million for each thimbleful of it, the milk finally becomes so changed that it injures the stomach and intestines of delicate human beings. Strong men may not notice the difference, but babies are almost sure to suffer. This is all the more pitiful because they have to use more milk than any one else.

As the table shows, those New York babies who used raw milk were taking anywhere up to ten million microbes with each twenty drops of milk they

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drank, and such a large number is sure to do great mischief.

The health department of New York City has decided that milk is not spoiled for use if there are no more than one million microbes for every twenty drops, but they say a larger number must not be allowed and that a smaller number is safer. To make things perfectly safe, doctors recommend boiled or pasteurized milk for babies and frail people.

Naples, Italy, is rather safer from microbes in milk than many other cities, because in that place the milkman drives the cow through the streets from house to house, and those who need milk may bring out their own milk pails and keep their eyes on the man while he does the milking. They may also see that he adds no water to what they buy.

Such milk is likely to satisfy the three conditions of pure milk, — freshness, cleanliness, and freedom from disease microbes.

In the milk that we use every one of the points might be lacking, and yet our eyes could tell us nothing about it. The fact is that bacteriologists with their microscopes are the only ones who can decide positively whether milk is pure or impure, for they are able to discover what is in it. During the same day, in the same city, in cans of milk standing side by side, these bacteriologists have found that one can may hold only three

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hundred thousand microbes to the cubic centimeter, while another can may have as many as one hundred and eighty million in the same quantity.

When this was made plain New York City decided that a business which supplies four million people with one of their most important lines of food must not be allowed to go on doing mischief to unsuspecting people. The health department, therefore, took up the matter and sent a man off to make investigations. He was to do two things:

1. To see how microbes get into milk in the first place.

2. To see what could be done to keep milk as pure as possible from the time it left the farm until it reached the city.[1]

[1] Boston, Washington, St. Louis, Chicago, Baltimore, Cleveland, Rochester, and many other cities are already wide-awake and active in regard to the purity of their milk supply.

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CHAPTER XX

FOOD INSPECTION (*continued*)

The inspector was to visit farms and cows in every direction.

This was a great undertaking, for New York City uses about a million quarts of milk daily, and it comes not only from New York State itself but from Pennsylvania, Massachusetts, Connecticut, and New Jersey. Some of it travels four hundred miles to get to the city, while among those who send it there is every sort of man owning every sort of cow: men who are clean and men who are unclean; men who are intelligent and men who are ignorant; cows that are well cared for, sleek, and clean, and cows uncared for and neglected; cows that are healthy and cows that are unhealthy.

More than that, the inspector soon saw that, according as the men and cows were clean or unclean, the milk was pure or impure. He also noticed how the milking was done.

In some cases each pan and pail was scalded, each stable clean, each cow groomed, while the milkman himself not only washed his hands before he milked but also wiped the milk bag with a damp cloth. Indeed, in

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such places as that "Cleanliness" was evidently the motto, for everything looked as if the owner had said: "You microbes may starve to death before I 'll give one of you a chance if I can help it. I am your enemy."

A Model Dairy

Clean cows, clean stables, and clean milk

Milk from these "model dairies," as they are called, is pure and sweet and safe. It is an astonishing contrast to that which comes from what we might call the "microbe dairies." Here the untidy farmer seems to say to his microbes, "Truly I 'm the best friend you have, and I 'll do everything to please you." In his stable,

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therefore, the inspector saw straw and dust on ceiling and floor, cows ungroomed, pans and pails unscalded. When milking time came there was no washing of hands or milk bag; on the contrary, with his hands as they were,

UNCLEAN MILK IS SOLD FROM HERE

the milkman took the pail, rinsed it with water that might or might not have disease microbes in it, went to the dusty stable, raised the dust by kicking the cow to make her stand up, slapped her on the side to make her move along, sat down on his stool, and began to milk vigorously.

To soften his hands, he wet them with the first milk he drew, letting it drop from them into the milk pail.

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As he now pumped up and down against the milk bag bits of dust went into the pail with the milk. At the same time flies troubled the cow, and to drive them away she often switched her tail from side to side. This raised more dust, and scattered tail hairs in the milk.

ICE TO KEEP MICROBES FROM MULTIPLYING

The milkman gave no heed, however, for, being ignorant, he supposed that straining would remedy all that. Finally, therefore, he sent the milk through a fine wire or cloth sieve; and if it moved slowly, as if the holes were getting stopped, he thrust his fingers in, stirred up the settlings, and hastened matters in that way.

His work was now ended; the milk was ready for the city and the babies.

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A bright high-school boy was talking about this matter the other day, and he said: "Yes, that's about the way it is; but you see, on our farm we use wire screens first, and then we run the milk through eight layers of cheese cloth. That takes the microbes out, does n't it?"

"By no means," I answered. "Once in they stay, for they are small enough to go wherever milk can go. Straining simply takes out straw, hair, mud, and so on."

One of the strong points about a model dairy is that men are careful to keep milk cold there. They know that the only way to prevent microbes from multiplying after they are once in the milk is to keep it as nearly ice cold as possible. This is done by packing ice around the can, not by putting it inside where it will do harm by adding water microbes to milk microbes, diluting the milk at the same time.

The two styles of dairies teach the same lesson from opposite sides.

Model dairies teach that:

1. The cleaner the milk the fewer the microbes.
2. The fresher the milk the fewer the microbes.
3. The colder the milk the fewer the microbes.

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Microbe dairies teach that:

1. The more dirt the more microbes.
2. The older the milk the more microbes.
3. The warmer the milk (before it is cooked) the more microbes.

In view of all this, the health department printed careful instructions about cleanliness, coolness, and pure milk. It sent these instructions in all directions, ordered railroad companies to keep cans of milk on ice as they carried them to the city, and set a standard of pure milk which I give in as few words as possible.

1. Pure milk must taste sweet.
2. It must not be weakened by water.
3. Chemicals must not be put in it to prevent it from turning sour.
4. It must hold no more than one million microbes per cubic centimeter.
5. It must not be kept for sale in any place where people live and sleep, nor in any place which opens into such a room.
6. It must not be skimmed before it is sold.

To make sure that the milk the city gets is up to the standard, when it first arrives the milk inspectors meet it here and there at different stations in the city. Their work begins at four o'clock in the morning, for then it is that trains begin to come in with their precious load, —

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over twenty-five thousand cans of milk, and forty quarts in each can. This shows how much of the milk supply of New York City comes in by train.

Some of it needs no examining, for it travels cold from clean farms that can be trusted. Other cans need careful testing, and whenever they fail to meet the standard they are seized and the owners fined.

MICROBES MULTIPLY IN THE SUNSHINE

The health department of Rochester, New York, allows but 100,000 microbes to each cubic centimeter of milk that is sold in the city. To make the quality even better during the summer months, when microbes multiply fastest and babies suffer most, there are special inspectors and special milk stations in different parts of the city. Here milk is sold so clean and so cold that the average number of microbes is only 10,000 for each cubic centimeter. To secure this, the city does its main work on a farm near by. On it each cow is healthy and clean; each stable and each milkman is equally clean; while bottles and cans are

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steamed and sterilized each time they are used. More than that, from the moment they are filled until the milk is sold they are closely packed in ice.

No pasteurizing or boiling is done on this farm, for at all times, everywhere, clean, sweet milk is the best food

CLEAN MILK FOR ROCHESTER BABIES

a baby can have. Boiled or pasteurized milk is the next best thing.

The diagram shows the results of this work in Rochester. Follow that slender line across the page and let your eye rest at each small, round circle. Now connect

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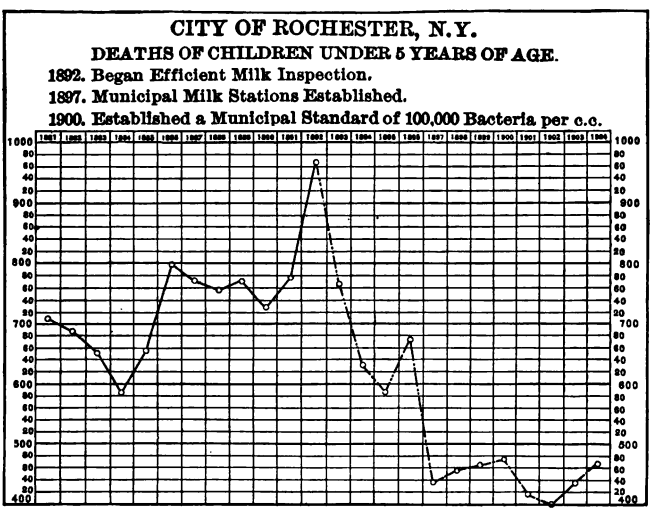
each with the figures which belong to it at the top and at the side of the diagram. Notice the year and the number of babies who died that year, and you will see what clean milk in Rochester has done for the death rate of city babies, — almost one thousand deaths in



THE MILK RECORD OF ROCHESTER

It shows how clean milk saved life

1892 and less than five hundred in 1904. Yet during the intervening years the city increased in size by about thirty thousand people. Surely every intelligent mother in the land must be wishing that she could take her baby to Rochester to live.

While trying to get pure milk, cities are also trying to get pure food of every kind.

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In June, 1905, Cleveland, Ohio, showed her zeal in this direction, for the inspectors then sent two thousand five hundred pounds of meat from the markets to the garbage plant. In May, 1906, the health officers were quite as much in earnest when they seized thirty-eight cattle, twenty-nine hogs, four sheep, and five calves, telling the owners that they were not fit to be killed and sold for food.

New York City is so particular in this matter that, in 1902, she destroyed over twelve million pounds of unfit food that various people were trying to sell. Boston does the same thing, and whenever a new market is opened in that city an inspector goes to the place and gives the owner a card stating the laws and penalties governing the business. With that as a beginning the same inspector often calls again to see whether the instructions are being obeyed. If they are not, he lets the law attend to the man, and this generally ends by improving him.

Thus it is with city after city. Each is trying to protect her citizens from spoiled meat and fish, poultry and oysters, vegetables, fruit, and milk. There is, in fact, a standard for every article of food we use,—for flour, sugar, coffee, tea, canned goods, honey, molasses, butter, maple syrup, and countless other things, and the duty of the inspectors is to see that what is sold matches what the law requires.

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CHAPTER XXI

EPIDEMICS AND THE DISCOVERY OF DISEASE MICROBES

Before any human being had so much as seen a microbe or suspected the harm it can do, a deadly microbe disease was killing off silkworms in southern France by the hundred thousand every year.

The serious side of the matter was that when silkworms died at that rate whole villages of industrious Frenchmen were plunged into poverty. These people are so zealous in their silk-raising occupation that sometimes the frames on which the worms live are distributed through a man's house from attic to cellar, while the man himself is as busy bringing in mulberry leaves by the armful and the sackful for the worms to eat as the worms themselves are busy with their eating.

Each day as these worms grow older they nibble away more persistently, until at last, when thousands of silkworms are eating in the same room, "the noise of their munching resembles the sound of rain falling upon thick bushes."

No doubt this sound is like music to the ears of the owners, for the one important thing in the life of a

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silkworm is that it should have a good appetite. When this begins to fail its owner is in despair.

It was this very thing, however, that happened in 1849. Just when the worms ought to have been eating the most they began to neglect their leaves; they moved slowly and did not grow; they also grew weaker, thousands died, and the eggs of those that lived either would not hatch or turned out sickly worms.

Worst of all, when the disease appeared in any room there seemed to be no way of keeping it there; it spread to the next room and the next, until all the worms in the house had it. Then from one house it traveled to another, and from village to village, until at last no region in the country escaped. Moreover, it was seen to be so deadly everywhere that the first sign of it in a single room gave any silk raiser a fright. He knew his case was hopeless, for with the disease once started nothing could save his worms or his business.

There was, however, one plan that did work for a while. Many raisers sent to other countries for their eggs, — to Spain, to Italy, to Turkey. In 1853 these foreign eggs hatched well. The worms were vigorous; they turned into beautiful cocoons that were sold to silk merchants for great sums of money, and everybody was encouraged, but only for a little while, for the epidemic was back again the year after, once more bringing discouragement to the silk raisers.

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More than that, it now spread to Italy, Spain, and Turkey. It reached every corner of Europe, until Japan was the only country in the world where healthy eggs could be found.

Finally, in 1865, thirty-six hundred important silk raisers and merchants sent a petition to the senate of France, begging the government to do something to help them. Fortunately, as those men turned their minds from one plan to another, some one thought of Louis Pasteur.

FROM A SILKWORM TO A MOTH

He was a careful, scientific man, who knew how to use both his brains and his microscope, and he consented to move down into southern France and see what he could do to save the worms. Even before he arrived he heard some one speak of having discovered small particles in the body of the worm. He himself now examined the worms with his microscope and found the particles without the slightest trouble.

For the sake of deciding what connection there was between the spots and the disease, he took two sets of

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eggs, — one laid by a moth without spots, the other by a spotted moth, — and raised them separately. Each set was hatched, ate leaves, turned into cocoons, came out of the cocoon as moths, laid eggs, and died. Meanwhile Pasteur watched these changes for several generations and learned four things:

1. A moth without spots lays eggs without spots.

2. Eggs without spots hatch worms without spots.

3. A diseased moth lays diseased eggs.

4. Diseased eggs always produce diseased worms.

The four points taken together showed that spots and disease were the closest companions, though they did not show how the disease traveled from a grown-up diseased worm to a grown-up healthy worm. That was the next thing to look into.

Since eating is the main occupation of worms, food experiments came first. Pasteur proposed to see if worms could take the disease by actually eating some of the spots. But the question was where to get those spots; for no one knew of their being anywhere except in the bodies of the worms, and it hardly seemed as if there were any way to make a healthy worm eat a diseased worm, even if science did need to be helped along. Yet Pasteur was keen enough to think up a happy

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device. He took a diseased worm, pounded it up with a little water, bought a small paint brush, dipped it into the worm mush, painted a few leaves with it, and gave them to his pet worms.

They took hold without the slightest hesitation, nibbled away diligently, and ate up the leaves without any fuss whatever. At the same time all the other healthy worms were eating unpainted leaves, and Pasteur wished to see whether there would be any difference in the health of the two sets.

Day followed day; each set continued as well as the other until finally twelve days had passed; then came the change. The painted-leaf eaters were not so well; spots appeared in their bodies; they were languid and did not eat. After that, until they died, the history of those worms was like that of all other worms that had the disease.

It was plain to Pasteur that he had a clear case. He saw that when a spotted worm was eaten by a healthy worm the disease went from one to the other.

Nevertheless, to make the proof doubly sure, he tried the experiment in various ways, — on young worms and old worms, on big worms and little worms, and always the disease followed. He became so skilled in doing it that he knew exactly when a worm should have the disease, and whether it should appear in the worms themselves, in the egg, the chrysalis, or the moth. He

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arranged all this by regulating the time and the manner of feeding them. Wherever he sent the disease there it went: either the eggs did not hatch, or the worms died, or the moths were diseased and laid diseased eggs.

Of course all that Pasteur had learned thus far was that if healthy worms took diseased worm flesh into their bodies they would have the disease themselves. He still needed to know how the disease generally went from worm to worm, for certainly, before this, no worm had ever had any chance to eat up his neighbor. Where, then, did this disease come from? By close watching and more experiments Pasteur now found that healthy worms took the disease even when they ate nothing worse than dusty leaves, or leaves that diseased worms had crawled over. This proved to him that what passed out of the body of a sick worm and either fell to the floor and turned to dust, or stuck to the leaf and stayed there, was full of something that gave the disease. It made the leaf as dangerous as if it had been covered with crushed worm paint, and showed that healthy worms and diseased worms must never be allowed to live together on the same leaf.

Next came the hook discovery. It seems that silk-worms have a way of helping themselves on with tiny hooks at the end of their feet. These hooks make little pricks wherever they fasten themselves, and the worm is quite as willing to hook himself across the back of a

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friendly worm as across any leaf or stick that comes in its way. The misfortune was that when a sick worm pricked its way over a healthy worm something from its body was left in the tiny holes, and the healthy worm took the disease.

In a way it was as if one worm had vaccinated the other, only in this case, instead of saving his life, the vaccination really killed him. Once more, therefore, it was plain that healthy and unhealthy silkworms must be kept apart. Certainly the problem was growing more and more serious; and with so many chances against them, how in the world were the healthy worms ever to escape? Yet the silk business of the whole of Europe depended on the answer to the question.

Fortunately Pasteur knew that during every silk-raising season all the worms hatch and die at about the same time. Between the seasons, there are no living worms, neither does anything in the dust live from one season to the next. It was clear, therefore, that all the disease that was going to do any harm was tucked away in the tiny eggs and nowhere else.

Since this was so, Pasteur saw that the only way to save the worms was never to allow a diseased egg to hatch. But who could ever tell which eggs were diseased and which were not? And even if this could be done, who would ever be willing to take the time to separate the two kinds?

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Really, however, the work was easier than it sounds; for, as we already know, healthy moths are sure to lay healthy eggs. It also happens that those who raise silkworms know perfectly well when any moth is ready to lay her eggs, and it was this fact that helped Pasteur to see a straight road out of the whole difficulty.

He decided that when laying time came each moth should be put on a separate, small piece of white cloth, where she would lay her wonderful treasure of four or five hundred eggs. After the laying, each was to be fastened to her own bit of cloth near her own eggs and examined for spots when her turn came. If she was found to have them, she herself, her eggs, and the cloth on which she had laid them were to be burned at once for the sake of saving the lives of all the others. If, however, she had no spots, her eggs were to be carefully kept for hatching.

This method was so successful that it was soon adopted everywhere in France; and to-day, in all the silk-raising villages, just after the egg-laying season, hundreds of women and girls are busy crushing moths, examining them under the microscope, burning some of the white cloth nests of eggs, and carefully saving the others. Finally Pasteur knew that the spots were microbes that multiplied, and through his discoveries he not only saved the silk industry of France but he also taught people how to study human epidemics and how

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to fight them. His four great discoveries are indeed more important to men than to worms.

1. There are such things as disease microbes.

2. Disease microbes carry disease from one individual to another.

3. The only way to learn how they do it is to make careful, scientific experiments.

4. Successful experiments will show how to check an epidemic.

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CHAPTER XXII

SOME SAFEGUARDS AGAINST EPIDEMICS

After Pasteur had discovered why it is and how it is that certain diseases travel fastest in crowded places, he made several other discoveries which taught men how to prevent epidemics in cities and how to save their lives in spite of microbes.

His first patients were chickens that had cholera and sheep that had splenic fever, and in both cases he actually used disease microbes to save their lives. To do this he took two drops of blood from a diseased animal, put each drop into a separate glass tube in a sort of beef-tea liquid, and let the microbes multiply there.

If he wanted what he called weak microbes, he left his tube untouched for days or weeks, for he saw that the longer he left the microbes the weaker they grew. If, however, he wanted strong microbes, he used the liquid within a day or two after he had prepared it.

In either case, when he was ready to use them he took a slender, needle-like syringe, drew a few drops of the liquid into it, and pricked them through the skin of a healthy animal. By many experiments he found that when he used strong microbes the animals died of the

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disease soon afterwards, but that when he used the weak microbes first, stronger ones afterwards, and the strongest ones last of all, the animals escaped with no illness whatever.

Pasteur finally became so expert in this matter that he said he could either give sheep and cows splenic fever or save them from it, according as he used his microbes.

The steps that led him to the discovery were so new and unexpected that when he finally announced the result to the Academy of Science in Paris, the entire body of learned men burst into loud applause. Some, however, wishing to see with their own eyes, asked Pasteur to give a public exhibition of his weak microbes, his strong microbes, and his sheep.

He was glad to do this. He was also glad to accept fifty-nine sheep, ten cows, and one goat from an agricultural society, for by experimenting on these he was to show whether he could really do what he claimed.

On the fifth day of May, 1881, with many visitors on the ground to watch him, Pasteur separated twenty-four sheep, six cows, and his one goat from the rest of the flock. To these he gave a dose of his weakest microbes, injecting them under the skin with his slender syringe. The rest of the flock received none whatever. Again, on the seventeenth of May he gave the same sheep, cows, and goat a stronger set of microbes. Even yet,

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however, he did nothing to the other animals.[1] They were reserved for the final treatment.

Then, on the last day of the month, he used the very strongest of his microbes not only on the animals already treated but also on twenty-five other sheep and on the four remaining cows. Each received the same dose so that all were treated alike.

By this time the scientists who watched the experiment were very much excited, for, of course, the question was which set of animals would suffer most, — those that had received nothing but strong microbes, or those that had had both kinds.

Pasteur himself had no question about it. He knew that in some mysterious way, when weak, splenic-fever microbes go on ahead as a sort of advance guard into the blood of an animal, the body prepares itself to resist any sort of splenic microbes that may come afterwards. He was so sure of this that he dared to make a prophecy about it. He said that not one of the sheep that had started off with weak microbes would die; that not one that had only strong microbes would live; that the weak-microbe cows would escape entirely, while the others would all have the splenic fever and would perhaps die.

He made that prophecy on the thirty-first of May, at the time that the strongest microbes were given. He also

[1] Ten sheep were set aside in the beginning, and from first to last these were not touched. The record does not explain the case of the goat.

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said that on the second of June the case would be decided. In the meantime, therefore, the strongest microbes were to do what they could to both sets of animals.

When the day arrived, two hundred people were on hand to see what had happened. Doctors were there and newspaper men; scientists, farmers, and senators. Some came believing and some came doubting; but all were ready to be convinced, and the proofs were before their eyes, for behold, each prophecy had come to pass. Twenty-four sheep and six cows were eating as calmly as if nothing had occurred. This was the set that had worked up from weaker to stronger microbes. Not so, however, with the rest of the flock, for of these twenty-one were dead already, three others were dying, the goat was dead, and the four cows had great swellings on their bodies and were too weak to eat.

The report of this marvelous experiment spread far and wide, and cattle raisers everywhere were now filled with such hope for the lives of their sheep and their cows that, during 1881, thirty-three thousand of these animals were treated with weak microbes to protect them from splenic fever, while in 1882 the number jumped to four hundred thousand. Since that time it has become quite the regular practice for farmers in France to save their domestic animals by the microbe cure.

For human beings in cities all this is most important, because it shows how we can conquer hydrophobia.

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In former times a man or child bitten by a mad dog could hardly expect to escape the disease; but those splenic-fever experiments led Pasteur to another great discovery. He never saw the hydrophobia microbe itself, but by the way the disease traveled from one to another he knew that it must be there and he treated it accordingly. Once more he worked on the plan of fighting the disease with microbes, and that is the cure to-day.

A rabbit dies of hydrophobia. His spinal cord is then taken from the spine and dried for two weeks in a cool, dark room to weaken its power. It is then crushed to a powder, mixed with a salt solution to make it liquid, and pricked through the skin of the man or child who has been bitten. The bite of the dog has left the strongest kind of hydrophobia poison in the man's body, yet in some way the preparation made from the spinal cord of the rabbit is able to save the man from this awful disease.

The treatment begins as soon as possible after the bite. The weakest dose is given first, with a stronger one every few days for two weeks afterwards. The strongest of all is then given and the patient is safe.

Quite as wonderful as all this is the way horses help in saving children from diphtheria. During the past few years, in the midst of their experiments, scientific men have found that at the very moment when microbes are multiplying in the body, or for that matter in the liquids where they are being raised in the laboratory, they are

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also manufacturing different kinds of poisons which they spread around themselves.

It happens, indeed, that each disease microbe has its own particular poison with which it does its own particular mischief. It also turns out that in many cases these poisons, even when they are separated from the microbes, are as swift to kill a man or an animal as the microbes themselves can ever be. This is true of that quick, cruel disease, diphtheria. In truth, poison, or toxin as it is called, is one of the principal weapons that diphtheria microbes use.

They reach the throat from the air, and often stay there harmless until the person has a cold or is not feeling well generally; then they begin to multiply fast. At the same time they manufacture their own deadly toxin which enters the blood and travels to all parts of the body. The patient now has high fever, and unless something can be done at once to save his life, the chances are that he will die from the poisoning and from the stuff that is growing in his throat.

Every year thousands of children in every land are killed in this way. At last, however, the remedy is at hand, for in 1890 Dr. Emil Behring announced his great discovery that the toxin of diphtheria itself can be used to save us from diphtheria.

In Detroit, Michigan, as well as in New York and a few other large cities, a group of noble, healthy horses

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spend their lives in clean stables, producing the remedy for us. Every day they are groomed and exercised, well fed, and treated like distinguished friends.

Still they have to endure some discomfort, for when they first enter the service they receive, under the skin, a dose of toxin without any microbes in it. Every few days after that they receive a larger dose in the same way, until at last they are immune; that is, it is now impossible for them to take the disease. Indeed, when once immune they can take toxin enough at one time to kill several horses that are not used to it.

They are immune because while they have been receiving the toxin into their bodies those same bodies have been manufacturing something that destroys its power. No one knows just what this is, or just what it does. We only know that after any particular horse is immune there is something in his blood that can be put under the skin of human beings to save them from diphtheria. This, therefore, is called antitoxin.

After those horses have received enough toxin to make them immune the tables are turned, and they have to contribute some of their blood once in a while, for the sake of the antitoxin that men wish to get out of it.

If we should visit the stables in Detroit where these antitoxin horses are kept, we should find each in his own special stall. We should also notice that each stall has

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its own small blackboard on which is written the name or the number of the horse, the date when he received his last dose of toxin, and the date when he must yield his blood to those who need it.

Everything is carefully done. The blood is taken from the neck of the animal, and he suffers no more than men used to suffer when they were bled for their health.

FRIENDS WHO RAISE THE ANTITOXIN FOR US

This blood is then allowed to stand until it clots or separates. The watery part — the serum, as it is called — holds the precious antitoxin which the body of the horse has manufactured. This is tested, filtered, put into small glass tubes in proper-sized doses, and sent here and there to save the children of the country from diphtheria.

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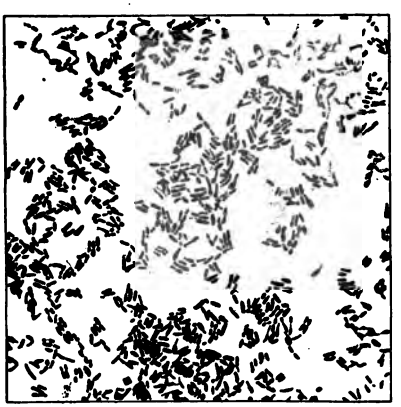
The discovery of this wonderful cure has changed the diphtheria record of the world. Formerly in New York City forty out of every hundred who had the disease died of it; now it kills not more than eight in each hundred. The truth is that the health department has worked hard for this result. In 1902 it divided the city into eight districts and appointed a special inspector for each one of them. These men were on duty day and night. When a case of diphtheria was reported to the department, it was at once telephoned on to the proper inspector, and he attended to it without a moment's delay.



DIPHTHERIA MICROBES

Indeed, in a case of diphtheria, after the microbes begin to multiply, there must be no loss of time in putting the antitoxin into the body, for it is clear that the less toxin the microbes have had time to make, the more easily can the antitoxin help the body to get the upper hand. In fact, it is now a life-and-death race between the two manufacturers. If the microbes can make toxin faster than the body can make antitoxin, they will win; but if the body is the swifter manufacturer, and if, at

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the same time, it is helped by antitoxin from outside, it will be victorious over the toxin.

For this reason everybody works fast with diphtheria. Fathers hurry to call the doctors or to send word to the health department; inspectors and doctors hasten to those who call them, and as soon as possible the antitoxin is in the child's body, doing what it can to help conquer the foe.

Antitoxin is then given to each person that has been exposed, for this astonishing substance not only overcomes the toxin which the microbes are already making, but, if it can have the start, it prevents those microbes from even beginning to make their deadly poison.

In New York City the health department furnishes antitoxin free to all who need it. It is given through inspectors and doctors, and as a result of its use, thousands of young people have been kept alive. Antitoxin has saved them from diphtheria.

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CHAPTER XXIII

VACCINATION

On a certain evening in June, 1905, in a certain lodging house in Cleveland, Ohio, one hundred and fifty men were either in their beds and bunks or were about to crawl into them, when five city doctors appeared and insisted on vaccinating every man among them.

Crippled men and blind men, young men and old men, all were summoned and all had to submit. Some were willing and some were unwilling, but the doctors were firm. They worked fast, took arm after arm as the men marched past, and within two hours all were safely vaccinated and the doctors gone.

The reason for the rush was that a man was down with smallpox in Rochester, New York, and he said that he had come from this particular lodging house in Cleveland. At once, therefore, the Rochester health officers telegraphed to the Cleveland health officers about it. They in turn telephoned to the doctors of the city, and no man among them delayed on the way for each one knew the danger. Each was, therefore, anxious to protect the men who had been exposed and to save the city from an epidemic.

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Unfortunately some of the men were ignorant enough to try to dodge the vaccination. They did not realize that the health department had actually been too good to them; it had kept them safe so long that they had no idea of the fearful fate that comes to places that have no wall of vaccination around them.

To understand this, citizens who object to vaccination should have lived on Ponape, one of the Caroline Islands, in 1854.

At that time a whaling vessel passed by, and a sailor with smallpox was sent ashore to die. His comrades sailed away and left him there. He died soon afterwards and was buried by the natives; but they saved his clothes, put them on, lent them to each other, and for a while were as proud as peacocks are of their splendid tails.

In the meantime, however, a medical missionary on the island did all he could to induce the natives to burn the clothes and not to wear them, but not one of them would give heed. "Surely the clothes are harmless," they said; "we have as good eyesight as the missionary and we see nothing dangerous about them."

That was in April, and then it was that the terrible history began. First a few were seized by smallpox, then others, and still others. All were ignorant: those who were ill lived and died with those who were well; each took the disease from some one else, and no one

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tried either to protect himself or to protect his friend. Thus the flame was fanned on every side, so that by the middle of May the scourging epidemic was sweeping across the island like a prairie fire.

The missionary had vaccine matter, but it was too old to be worth anything. He therefore determined to try inoculation on himself first and then on the natives. This means that he scratched the skin on his own arm, took a bit of pus from one of the sores of a man sick with smallpox, and rubbed it into his scratch.

If he had not already been protected by vaccination, this inoculation would have given him a slight attack of smallpox and made him safe from the disease for the rest of his life. As it was, however, he found that his American vaccination was still protecting him.

He now turned his attention to the natives. At first they were afraid to trust him. They said that a foreign God had sent a foreign disease to kill them, and they did not see what good a foreign man could do in such a case. A few, however, dared let the missionary inoculate them, and when others saw that these escaped they tried it too.

There was reason in this, for on every side whole villages of men, women, and children were groaning and suffering and dying together.

To escape their fate those who were still well now flocked to the missionary by the dozen and the fifty each day. They came walking through the valleys and sailing

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in their canoes from every village on the island, — old men, and babies in their mother's arms, young men, and grandmothers too, all came together. Sometimes the babies screamed with fright, but their mothers held them firmly while they were inoculated; for by this time they were sure that fright for a baby is not half so bad as smallpox.

The epidemic spent six months working its way across the island. When it started there were ten thousand people on Ponape, and, in spite of all that inoculation had done, when the six months were over half of those merry, ignorant, brown-skinned people were dead and buried; and one sailor with smallpox was the cause of it all. While it lasted the missionary wrote, "I have never witnessed such wretched and harrowing misery." And when it was over he wrote again: "We still hear but too distinctly the groaning and screeching that echoed through whole neighborhoods of beautiful bread-fruit groves. We can give no adequate idea of the deadly gloom that hung over us during those dreadful months."

It is from such woe and suffering that vaccination saves our cities. In these days, however, people are, as a rule, so well protected by this vaccination that even good citizens sometimes grow thoughtless about the very thing that protects them; but the starting of a smallpox epidemic is sure to frighten them into vaccination again.

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New York City shows this by her records. Notice the table; it starts with 12 people who had the disease in 1898 and climbs steadily to 1198 in 1901. Of that number 410 died.

Date	1898	1899	1900	1901	1902
Cases of smallpox	12	54	132	1198	755

In December, 1901, there were four times as many cases as in November of the same year. Fortunately, however, the health department of the city now became so thoroughly alarmed that, in 1902, it appointed two hundred vaccinators for special service.

It also sent letters to all the large manufacturers and business men, saying that the city would not only be glad to send a vaccinator to any shop or factory, "at any time of day or night," but that nothing would be charged for the work done, and that even the vaccine matter would be given free of charge.

In fact, all the department asked was that each unvaccinated citizen would have the kindness to lend his arm to the city for a minute or two and allow it to be vaccinated. The health officers knew that any arm lent for that purpose would do more for the protection of the man himself and of the city than if it carried a gun for the shooting of some visible enemy.

The truth, of course, is that in every city it is the invisible foe that does more harm than any visible foe can

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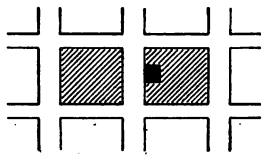
ever do; and in the case of smallpox the arm of a child is as strong a defender as the arm of the strongest man.

Besides sending letters and circulars of information in all directions, the health department ordered doctors and inspectors to report each case of smallpox they found; and within forty-eight hours after the report came in the department proposed to vaccinate every man, woman, and child who lived within two blocks of the infected spot. To do this, the whole company of vaccinators was sometimes rushed to the same part of the city at the same time.



VACCINATION IS REQUIRED

Special inspectors visited every New York lodging house once a week. They even went to the bedrooms, when this seemed to be necessary, wakened people, vaccinated them, and gave them certificates to that effect. These certificates were necessary just then, for the city had made a rule that no man should be allowed to spend two consecutive nights in any city lodging house unless he had a certificate stating that he had been vaccinated recently.

Thus it was that New York City carried on her smallpox war. Her officers were doctors, inspectors, and vaccinators, while her private soldiers were of every age and size; for each citizen who had been vaccinated was in the army of defense, and vaccine was the powerful weapon.

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So much was done that from one hundred and ninety cases in January, 1902, the number dwindled to nine in December. It had taken two hundred vaccinators six months to do the work, and during that time they had vaccinated eight hundred thousand citizens.

THEY RAISE VACCINE TO SAVE US FROM SMALLPOX

This is the way cities protect themselves in these days. The very first discovery of how to save by vaccination was made by Dr. Jenner, an Englishman, in 1796. He saw that milkmen often had sores on their hands, which they caught from the cows they milked; he also noticed that such men were as safe from smallpox as if they had been inoculated; and by putting two and two together he concluded that if a milkman can be

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saved by accident through sores on the cow he milks, it ought to be possible to save other men on purpose through the same sores on the same cow. That was his great discovery. He called the pus "vaccine" because *vacca* is the Latin name for "cow." Since that time men have found that to be perfectly safe from smallpox they need to be vaccinated about once in seven years.

To make sure that the vaccine they use is as pure as possible, they raise it on special calves that are kept for the purpose. The calves shown in the picture live in Detroit, Michigan. They belong to the same company that owns the antitoxin horses.

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CHAPTER XXIV

THE ENEMY OF THE CITY, — TUBERCULOSIS

When the steamboat *Slocum* was burned on East River in 1904, and when nine hundred merry excursionists were either burned to death or drowned in a single afternoon, the entire country was filled with horror. Newspapers used huge headlines; teachers, preachers, doctors, and lawyers talked of criminal neglect and wicked waste of life; while New Yorkers themselves said that death from a preventable cause like that must never happen again.

Now notice these other facts and compare the situation.

During that same year (1904) in the same city of New York, instead of nine hundred who died by fire and water, ten thousand other men, women, and children died of that other preventable cause, tuberculosis. Not only was this the case in New York, but in the United States as a whole one hundred and fifty thousand human beings died of tuberculosis that year, and in the world itself perhaps a million.

Strange to say, however, in this case neither newspapers nor citizens grew very much excited, probably for two reasons:

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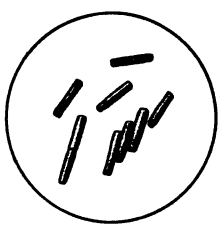
1. Few people know what the awful death record is.

2. Fewer yet know that tuberculosis can be prevented.

The fact is that until 1882 no one knew either how the disease travels or how to cure it. At that time, however, Dr. Robert Koch found the microbe that gives tuberculosis, and through his discovery the death record of the world will be changed forever.



TUBERCLE BACILLI

Three thousand put end to end will measure one inch

He examined the microbe in his laboratory under his microscope, noticed its size and shape, studied its habits, watched it multiply, found out what kills it, and also what makes it grow faster. He did all this, knowing as well as we do that every point he learned about it would help to save the lives of men. Here are a few of his facts packed closely together:

1. The real name of the microbe is tubercle bacillus.[1]

2. It is small and slender like a tiny rod.

3. Three thousand of these microbes put end to end will measure one inch.

4. Each separate one of them is a separate plant.

[1] The plural of "bacillus" is "bacilli."

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5. Each multiplies by dividing.

6. The only place where they can multiply is in the bodies of men and animals, or in laboratories where scientists raise them.

7. After they leave the body they live, but apparently they cannot multiply.

8. They live best in damp, dark places.

9. In such places they live anywhere from a few weeks to two years.

10. Bright sunshine kills them in a few hours.

11. Boiling kills them at once.

12. Cold does them no harm.

13. They can live and float around in the driest dust.

14. They may give tuberculosis to any part of the body.

15. They give it to the lungs most often.

16. Tuberculosis of the lungs is what we call consumption.

The discovery of all these facts, one by one, was exciting to every doctor, every scientist, and every consumptive who heard about them; for each one knew that a turning point had come in the history of the disease, and that there was hope now for thousands of people who were hopeless before.

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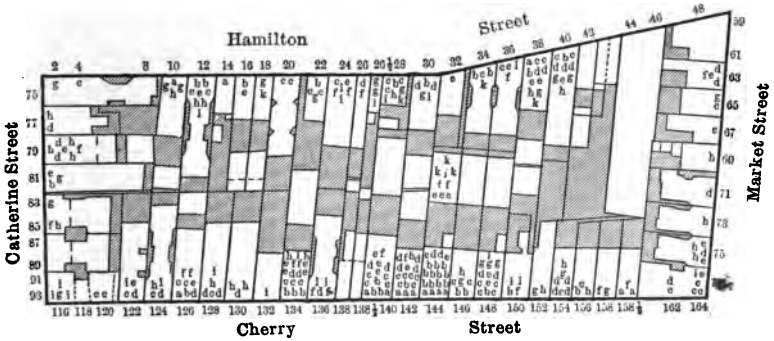
It was also clear that, from the highest to the lowest, from the richest to the poorest, from the wisest to the most ignorant, all sorts of people were exposing others to the disease every day, and that each one was blameless; for until Koch's great discovery no one knew the facts about the tubercle bacillus. Now, however, various



"LUNG BLOCK"

The shaded parts show courts and air shafts. Each letter stands for one case of consumption reported since 1894. All the "a's" belong to 1894, the "b's" to 1895, the "c's" to 1896, etc., up to 1903

earnest men and women learned these facts by heart and studied the history of tuberculosis in cities.

They found that, as a rule, there is more consumption in the crowded parts of a city than anywhere else, and that even here there is the greatest difference in special houses and special rooms. This was the case with what is called "Lung Block" in New York City. Here during nine years two hundred and sixty-five cases were reported to the health department, and very many

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more were unreported. Single rooms also told their sad stories.

Mr. Ernest Poole, who has studied the subject thoroughly, gives the report of one of these rooms for seven years. He says it is on the third floor, looking down into a court, and that in it people died of consumption steadily, one after the other.

1. A blind Scotchman, in 1894, had consumption, went to the hospital, and died there.

2. His daughter had consumption and died.

3. One year later a Jew was taken ill there and died in the summer.

4. A German woman took the disease, died, and left her husband there.

5. An Irishman was the victim. He worked hard, caught the disease, fought against it bravely, but died in 1901.

Another house on the East Side of the city has dark halls where you must grope your way about; seventy small rooms, with almost no outside air and light, and an air shaft partly filled with rubbish and filth. One hundred and fifty people live in that house and die fast of consumption. In the middle apartment, on the second floor, five families were lodged, one after the other, for four years. One of the first family died, two from the

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second, and one from the third, while two members of the fourth family died in the hospital after leaving the place.

At the last report a fifth family of eight persons, was living in the same rooms, and it is hardly to be supposed that they will all escape the fate of the others, yet after they have lived there for a while, after one or two of them have died there of consumption and the rest of the family have been frightened away, other people will visit the rooms. They will look around and will notice nothing more objectionable than darkness, dirt, and close air. They will discover no microbes, will suspect nothing, will agree to pay the rent, and will come to the rooms to live; they will not know that, instead of long life there, the chances are that some of them have come to those rooms to die and not to live.

Now how does it happen that, over and over again, after there has been one death from consumption in a house other cases are almost sure to follow, and then still others again, for years and years afterwards?

The whole explanation is in the power of the microbe, the tubercle bacillus itself. Those who examine the room can, of course, see no sign of these microbes, yet there may be millions of them in the dust on every side. They may be lodged in the cracks of the floor, may be clinging to the walls and the ceiling, or may be hidden in the folds of the curtains. Often all they need is to be stirred up by a broom that has not been dampened, or

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to be flourished about with a feather duster; for they are thus tossed into the air and are ready to do their mischief.

As we learned in *Good Health* dry dusting is a calamity to those who live in any house, for it simply lifts the microbes from the spot where they are quiet and harmless, and scatters them in the air where, until they settle again, they threaten all who breathe it. Damp dusters are therefore necessary, and wet sawdust or torn-up damp paper scattered on the floor before sweeping will keep down these microbes.

It is not in tenement houses alone that these microbes are found, but any room, however richly furnished, is able to protect them if they are once scattered in it, while deep velvet and plush are fine shelters for them. After microbes once reach such a room, if care is not taken to disinfect it and kill them, they will live there for months and even for two years.

The very nature of the microbe explains all this. It has no mind. It makes no plans. It simply lives on when nothing kills it, and multiplies when it finds a comfortable home. Yet it never goes hunting for a home, for it cannot move about on its own account. On the contrary, if it is in the air, the wind may drive it anywhere, and it will stay where it is tossed until something starts it moving again. It is so small that a man may breathe it with the air. It may escape all the cilia and

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the mucus of the air passages, and safely reach the spot where it grows the best, the lungs of a human being.

Here everything is favorable. The place is warm and moist, the delicate tissue is good ground to grow in, and the microbe begins to multiply promptly.

Yet there is another side to the situation. The lungs themselves seem to make a protest. They like the microbe no better than a human eye likes a bit of cinder. At once, therefore, certain cells of the lungs hurry to the spot, surround the microbe, and try to build themselves into a wall about it. In a way it is a sort of contest, and at last the multiplying microbes and the cells are bunched together in a hard lump called a tubercle.

Sometimes the cells of the lungs are vigorous enough to fasten the microbes up so securely that they cannot multiply. In this case they become harmless and the man does not have consumption. At other times the microbes prove to be the stronger of the two. The tubercles then increase, the man's lungs gradually become useless, — his whole body being also poisoned by the multiplying microbes, — and finally he dies.

The danger to other folks comes before that. It seems that as each tubercle grows larger the center of it softens, and the man coughs it up if he can. This is the sputum so full of danger. Often it has a yellow color and is full of the microbes themselves. The worse off a man is, the more he coughs and expectorates; while the more he

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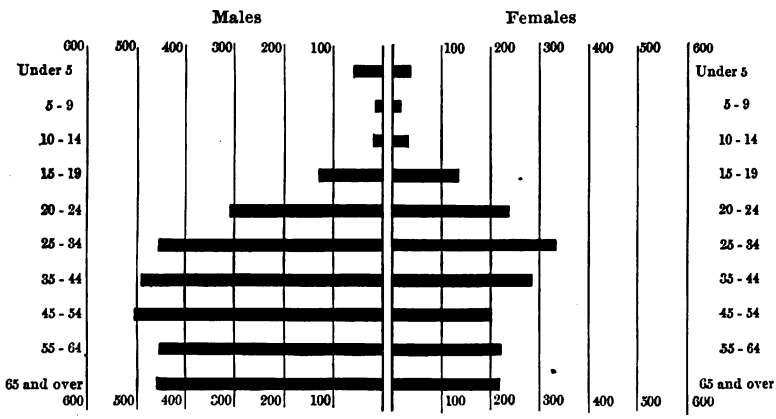
expectorates, the more living, dangerous microbes he sends into the world.

Those who know about it say that a man with consumption may expectorate two or three billion tubercle bacilli every twenty-four hours. Such a man may wet his handkerchief with the sputum; he may get it on



MORTALITY OF CONSUMPTION IN NEW YORK CITY IN 1900

The black bars show the number of deaths for each 100,000 living citizens of the same age

the sheets and clothing; and there, as anywhere else, it dries, flakes off, flies about, and carries danger.

Strange to say, in cities the greatest danger is for people between fifteen and forty-five years of age. The two diagrams show the case for New York. In one of these notice the black bars that grow longer for certain years, and then shorter again as the age increases; in

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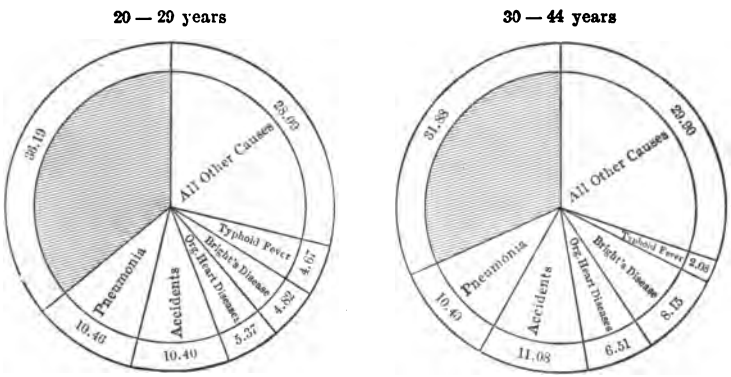
the other notice the circles which show the number of deaths of men and women between the ages of twenty and forty-four; also the great dark section which shows the proportion that died from tuberculosis.

If consumption, a preventable disease, had been prevented in New York City in 1900, that whole dark



THE DEATH RECORD OF NEW YORK CITY

Each disease according to its proportion of the whole. The large, dark space stands for tuberculosis

space would stand for living men and women who were healthy, happy, and busy at the end of 1900. Instead, those citizens all died at the age when they should have been working most busily.

Instead of tuberculosis of the lungs young children are more apt to have tuberculosis of the bones, which gives them crooked backs and hip disease. This is often cured, as the chapter on hospitals shows.

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Fortunately, however, no one inherits any kind of tuberculosis. To be sure, children of consumptive parents often have it, but they have every chance to take it after they are born; for they may live in the same house with their careless, consumptive parents, may touch the same things, breathe the same microbe-laden air every day, and may even creep around on the floor, where dust and microbes are thickest. Worse yet, without intending the slightest harm, those parents may even kiss their children on the lips. They do not know that this should never be done.

With thousands of careless citizens coughing and expectorating every day for months and for years, it is easy to understand how streets and houses, rooms and people, all become infected; for each new case of a person who is careless with his sputum means more microbes to shift about, and at a moment's notice, they are ready to go back into the lungs of any human being who breathes them. After that the vigor of those lungs themselves is the only thing that can save a man.

We see, therefore, that there is no question about the mischief which tubercle bacilli can do. Just as leaves painted with one kind of microbe give disease to silkworms that eat them, and as typhoid microbes in drinking water may give typhoid fever to those who drink it, so it is that the microbes of consumption in the dust of the air may give consumption to those who breathe it.

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CHAPTER XXV

WAR AGAINST TUBERCULOSIS

It is as true to-day as it ever was that the person who breathes dust loaded with tubercle bacilli is in danger of tuberculosis, and that the only way to escape the danger is to keep the lungs healthy and not to breathe such dust.

Yet how shall we keep from doing this?

Careless people leave their deadly sputum in crowded rooms, cars, theaters, stations, and saloons. It then passes through all the stages of drying, being crushed, turned to powder, and getting into the air; and afterwards, in each of those places, people breathe the air thoughtlessly. In New York City a man breathes anywhere from ten to four hundred microbes a minute, according to the place he is in; and the larger the number the greater the chance that tubercle bacilli are among them.

When, therefore, you see a man expectorate carelessly in public you have a right to say to yourself: "One thing is plain — either that man is absolutely ignorant or absolutely selfish; either he does not know the laws of health, the laws of the microbe, and the laws of the city against spitting, or he is willing to run the risk of giving a deadly disease to his fellow-citizens."

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Of course it is true that saliva without tubercle bacilli in it can do no harm; but cities know, as we do, that what a well man does the ill man is sure to do. For this reason laws against spitting cover every citizen, young and old, well or ill. Many cities post their laws in cars, stations, and all public places, and they enforce them or not according to their zeal for the welfare of their citizens. Here is a New York notice:

> Spitting on the floor of this car is a misdemeanor. $500.00 fine or imprisonment for one year, or both, may be the punishment therefor.

The city is so much in earnest that men in tall silk hats as well as those in shabby derbys have been fined for breaking that law. The truth is that New York City leads the country in this tuberculosis war. Moreover, she has two great branches to her fighting army:

1. The health department of the city.
2. The Committee on the Prevention of Tuberculosis for the Charity Organization Society.

The triple motto for both divisions and for each separate soldier seems to be:

1. Tuberculosis is preventable; we will prevent it.
2. Tuberculosis spreads; we will check it.
3. Tuberculosis can be cured; we will cure it.

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In carrying out this motto the city has sent inspectors to infected rooms, has ordered houses to be pulled down because they were not fit to live in, streets to be widened and cleaned, parks to be increased, knowing all the while that there are just two ways to save a city.

1. By destroying the tubercle bacillus.
2. By making the bodies of citizens strong enough to resist them.

The health department does two other things:

1. It asks city doctors to report every case of consumption which they find.
2. It offers to examine, free of charge, any specimen of sputum that is sent to the city laboratory.

Every doctor in the land knows how important both these points are, for the secret of curing consumption is to discover it when it first begins, and the only possible way to do this is to examine the sputum for tubercle bacilli.

Tuberculosis of the lungs is really somewhat like a fire in a lumber yard. If the fire is discovered when it first starts, a single pail of water will dash it out; but if it is left until the whole lumber yard is blazing, even the fire department cannot be of any help.

So too with tuberculosis. Three quarters of the cases found early and taken care of are cured, while the cure itself is often as simple as the fire cure, although in

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the case of consumption four things are needed instead of one:

1. Fresh air from morning until night and from night until morning.
2. Sunshine.
3. Wholesome food with an abundance of fresh milk and eggs.
4. Rest for body and mind.

If the patient discovers the disease soon after he takes it, and if he can get those four things, he will probably recover; if he cannot get them, he will probably die.

Those who understand tuberculosis best speak very positively about using medicines for it. They say:

1. No medicine has yet been found that will cure consumption.
2. Advertised medicines often contain alcohol, which hastens consumption.
3. No person with consumption can afford to run the risk of taking any advertised medicine.
4. In taking medicine a consumptive should go by the advice of a good doctor.

Then too, from first to last, they should seek those four best things, — fresh air, sunshine, wholesome food, and rest; but these are often hard to get.

When men and women who have consumption are crowded into dark rooms of towering tenement houses in

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such a city as New York, how are they to get fresh air twenty-four hours a day? When they have dark closets for living rooms, how are they to find their sunshine? When they have little money, how can they afford to buy the freshest eggs, the freshest milk, and an abundance of wholesome food? When they need to work for daily bread, how can they stop to take rest enough for body and mind?

The health department of New York City tries to answer these questions by giving help to citizens who need it. Some are sent to pleasant places in the country, others receive fresh eggs and milk in their own homes, and still others are cared for by the dispensaries and hospitals of the city. At the same time, directions are sent out by the hundred thousand printed pages, telling citizens what the danger is, how they may protect themselves from it, and what they must do when they find that they have the disease.

In 1902 New York doctors reported thirteen thousand new cases of tuberculosis, and in 1904, by adding new cases to old cases, there were found to be at least thirty thousand consumptives in the city.

Since this is so many more than the health department can take care of, each separate citizen needs to know what he can do for himself. The wisest of them will see to it that windows are open in their homes, their shops, and their schoolhouses. They will keep them open by

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night as well as by day, for they will know that less dust is being stirred up at night and that night air is, therefore, the best air to be had.

At the same time, they will make sure that their bodies are warmly covered when they sleep in cold rooms full of fresh air. A quick, inexpensive way to get extra covering is to sew newspapers between blankets. Paper does, in fact, keep cold out so well that in some places paper blankets are manufactured, and they can be bought by the dozen for very little money. Keeping warm enough and breathing fresh air must go hand in hand.

In a city even hospitals have trouble in giving a man all the air he needs. Windows are kept open and reclining chairs are put on the roof for certain patients to use. Other patients breathe fresh air even in bed, for the cot itself, with the man on it, is thrust through an open window into the air and sunshine. Other devices help, but a sanatorium or a tent in the country is best of all.

The United States and Canada have thirty-eight such places, distributed in every climate from Maine to Florida and Hawaii. Some are called hospitals, others sanatoria, and still others tent colonies, and it is these last that give the most air and the most hope. Doctors recommend them, saying that if ten hours of fresh air are a help, twenty-four hours will help still more.

Some consumptives go even farther than tents and actually sleep out of doors in midwinter.

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Mr. Irving Fisher says that he did this when the temperature was ten degrees below zero. He also says that in the winter of 1904, in the Adirondack Cottage Sanatorium, six people slept outdoors when the temperature was thirty degrees below zero. They had two or three mattresses under them, warm blankets and comforters

FRESH AIR IN A CITY

over them, heavy night clothes about them, and also woolen "head gear" with an opening for the nose.

Each person knew that the more fresh air he could get the more chance he had to live. It even seemed as if the colder the air the better he felt.

Thus the war against tuberculosis goes successfully on, and all good citizens are turning into energetic fighters in the army.

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A few years ago no one protested when a man left his saliva on the sidewalk or floor of a car or station. It was so common that almost no one noticed the spitting. Now, however, the man who spits is seen by a dozen different people at once, and each one looks upon him as either a deserter from the camp of good citizens or as a friend of the enemy.

A TENT COLONY
Air and sunshine to cure consumption

For his own sake, therefore, as well as for the sake of his city, each loyal citizen should practice the following rules of prevention. By so doing he will prove his loyalty.

1. Never spit in a place where sputum may dry and get into the air.

2. Use paper or cloth and burn the sputum before it dries, or else use a spittoon that has water in it to prevent the microbes from drying and floating around in the air. Such spittoons should be properly cleaned.

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3. If there is a persistent cough and a good deal of sputum, tell the doctor about it. He will have the sputum examined.

4. Obey the laws of health, that is, breathe deeply, have plenty of air and sunshine, wholesome food and sleep, be clean, exercise faithfully, and be careful not to take cold.

Consumptives who follow these rules are not in danger of giving the disease to others. They may live under the same roof with them, work side by side at the same bench, breathe the same air from day to day, and yet, from first to last, if they destroy every drop of their sputum, other people are not in danger. As tubercle bacilli never fly away from a damp surface, they stay in the throat and air tubes of a consumptive and do not get into his breath unless he breathes hard or sneezes. If he does either of those things, he should hold a cloth before his mouth and burn it immediately, or have it boiled.

Any citizen with a vigorous body is best able to resist every sort of disease microbe. To secure this body, let each of us learn to shun what have been called the five tuberculosis D's, — dirt, darkness, dampness, dust, and drink. Let us also practice the golden rule of the anti-tuberculosis leagues:

Don't give consumption to others.

Don't let others give consumption to you.

In this great anti-tuberculosis war cities are sure to be victorious in the end, but how soon the end will come

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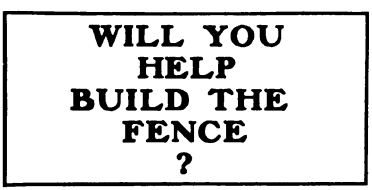
depends on whether the children of our cities understand how serious the danger is, and whether they are ready to help fight it.

Since this book was written the Maryland Association for the Prevention and Relief of Tuberculosis has been through an exciting campaign. Its rally call was, "Will you help build the fence?" And for twenty-three days this mystic query appeared in large letters on every street car in Baltimore, and on nearly every blank wall; even the ash cans did not escape. At first there was curiosity on the part of those who saw the sign; next came interest; and when the meaning of the question slipped out, when all knew that it meant a "fence" of prevention to protect citizens against consumption, there was such enthusiasm that, in less than three weeks, ten thousand dollars were raised for the use of the Association during 1907.



Such an experience as this shows one of the ways in which cities north and south, east and west, are already preparing to attack the enemy. It also proves that we have reason to expect to be successful in our united warfare against tuberculosis.

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CHAPTER XXVI

CITY HEALTH AND ALCOHOL

An intelligent American trained nurse was speaking of her work in Cuba during the Spanish-American War. She said:

Yes, I was there three months. I spent my whole time taking care of typhoid patients, and I saw what alcohol did for the poor fellows. I remember three cases in one week. They were all soldiers, they all had typhoid fever, and they all had to be operated upon.

The first was a fine young fellow twenty-five years old, who had never smoked or used alcohol. He was so near dying that it hardly seemed as if we could get him to the operating table alive. Still the doctors tried it as a last chance, and sure enough, he began to get well almost as soon as the operation was over. The second was in the habit of drinking whenever he had a chance. The third drank once in a while. Neither of these seemed so very sick, and it looked as if they ought to recover. Nevertheless, the drinker died the day after the operation, and the moderate drinker three days later.

The doctors who examined the bodies said that in both cases the heart and intestines were so damaged by alcohol that it would have been a marvel if the men had recovered. You see, sometimes we really have to use a little stimulant to pull a man over a crisis, but if he has the alcohol habit, a little won't do him any good, and if we give him much, he is so weak that he's almost sure to die from it.

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"What do you do then?" we asked.

"Nothing," she answered. "There's really nothing we can do; we have to let him die."

This seems bad enough and sad enough, but in such an important matter as this no one should depend upon the judgment of any one person. Fortunately for us, scientists have looked into the subject of alcohol and health most carefully.

Professor Guttstadt of Berlin has studied the record of the Gotha Life Insurance Company, and the Prussian government has published these records in the *Klinishen Jahrbuch* for 1904. It seems that Professor Guttstadt looked up the causes of death of men over twenty-five years of age, and he learned that in Prussia one hundred and sixty-one people out of every thousand die of tuberculosis.

He then wanted to know in which occupation there was the greatest number of deaths from tuberculosis. So he compared again, and found that:

Of	every	1000	bartenders	who	die,	556	have	tuberculosis
"	"	"	brewers	"	"	345	"	"
"	"	"	school-teachers	"	"	143	"	"
"	"	"	physicians	"	"	113	"	"
"	"	"	clergymen	"	"	76	"	"

The explanation of the death rate is plain enough. People expectorate more in saloons than anywhere else, and just there, too, they are specially careless as to where

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the saliva goes. Sometimes it gets into a receptacle that may tip over afterwards. Sometimes the half-intoxicated man cannot see straight enough to use any receptacle at all, and therefore uses the floor instead. In any case, no matter how it gets there, saliva on the floor, getting dry, being stepped on, turning to powder, floating into the air with tuberculosis microbes in it, is a danger to all who breathe in the room, and to bartenders most of all, because they stay there longest.

Yet air is not the only carrier of disease. In most saloons the glasses, instead of being scalded after each drinker, are simply rinsed in cold water, and microbes from the lips that have just used the glass are not killed before the next man puts the same glass to his lips. Many diseases travel in this way from mouth to mouth, but, not suspecting it, people drink on most carelessly.

Between 1847 and 1849 a great cholera epidemic in Glasgow attracted so much attention that Professor Adams studied it carefully for the sake of telling the people how to protect themselves. He discovered that of those who used alcohol and caught cholera ninety-one out of every hundred died, and of those who did not use alcohol and had cholera nineteen out of every hundred died.

He also noticed that during the epidemic most of the new cases came after a holiday or Sunday, when people had been doing special drinking, and from what he saw,

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he was so sure about the share which alcohol had in spreading the disease that he said the sign over every saloon ought to be, " Cholera for sale here."

Dr. Thomas, in Strassburg, was so much interested in the same subject that, having no epidemic to follow, he experimented on rabbits with alcohol and cholera microbes. In doing this he found that when the little creatures had been dosed with alcohol six times as many of them died as when they had not had the alcohol. From many different experiments he came to the conclusion that even a small quantity of alcohol affects the blood in such a way that it loses its power to destroy disease microbes.

This seems to be the case even with people who take beer.

Toledo, Ohio, is one of the principal beer cities of America, and various people there are making thousands of dollars every year by selling beer to their countrymen, as well as to Germans who have moved to the city. A newspaper called the *Toledo Blade* is bent on learning exact facts. Therefore, instead of asking those who drank beer what they thought of it, the *Blade* sent an intelligent man around to ask the best doctors of the place whether beer did any harm to their patients. One after the other gave the same answer.

Dr. S. H. Burgen, who has been practicing in Toledo for twenty-eight years, said:

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I think beer kills quicker than any other liquor. My attention was first called to its insidious effects when I began examining for life insurance. I passed, as unusually good risks, five Germans, young business men, who seemed in the best health and to have superb constitutions. In a few years I was amazed to see the whole five drop off, one after the other, with what ought to have been mild and easily curable diseases. On comparing my experience with that of other physicians I found that they were all having similar luck with confirmed beer drinkers, and my practice since has heaped confirmation on confirmation.

As for those who need operations he said: "Beer drinkers are absolutely the most dangerous class of subjects a surgeon can operate on. All surgeons hesitate to perform an operation on a beer drinker."

Dr. C. A. Kirkley said, "Sickness is always more fatal in beer drinkers, and accidents are usually fatal to them."

Dr. S. S. Thorne said:

If you could drop into a little circle of doctors when they are having a quiet, professional chat, you would hear enough in a few minutes to terrify you as to the work of beer. One will say, "What's become of So and So? I haven't seen him around lately." "Oh, he's dead." "Dead! What was the matter?" "Beer," comes the answer. Another will say: "I've just come from Blank's. I am afraid it is about my last call on him, poor fellow." "What's the trouble?" "Oh, he's been a regular beer drinker for years." And so on, till half a dozen physicians have mentioned fifty recent cases where apparently strong, hearty men, at a time of life when they should be in their prime, have suddenly dropped into the grave. To say they are habitual beer drinkers is sufficient explanation to any physician.

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So in Toledo many doctors said the same thing. But there are other cities and other drinks. Dr. Willard Parker, one of the most noted physicians of New York, once said, "One third of all the deaths in New York City are caused, directly or indirectly, by alcoholic drinks."

Sir Andrew Clark, a famous London doctor, put the figure higher yet.

I 'm speaking solemnly and carefully in the presence of truth, and I tell you I am considerably within the mark when I say to you that, going the round of my hospitals to-day, seven out of every ten there owed their ill health to alcohol. Now what does that mean? That out of every hundred patients whom I have charge of at the London Hospital seventy of them directly owe their ill health to alcohol. I do not know that one of them was a drunkard.

Still all this is about the effect that alcohol has on the bodies of men. But one and all agree that the worst damage is to the mind and character. They say that very often the will is weakened by alcohol, just as the muscles are weakened by fever. In fact, the more alcohol a man takes the weaker his will grows, while the weaker his will grows the more alcohol he takes. After that, in thousands of cases, it is a rapid whirl down to destruction. As Professor Atwater says, "Saddest of all is the effect upon the mental functions: the weakening of the will and the deadening of the moral sensibilities, the ruin of character which is wrought by alcohol as a drug."

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As far as families and cities are concerned the most serious thing about alcohol is that the drinker who goes to destruction because of it does not go alone. He usually drags others along with him, and his dearest friends suffer most.

A certain beer-selling society in England had been objecting to something that Mr. Justice Grantham said about alcohol, whereupon he stated the case more positively than ever, showing just how it is that innocent people suffer.

I have lately been brought face to face for weeks with the conduct of publicans (saloon keepers) in the carrying on of their business, which has resulted in the most heart-breaking crimes it is possible to imagine, — husbands murdering their wives, wives their husbands, fathers their sons, friends their own best friends, all through the maddening influence of excessive drinking. Twelve murders, eighteen attempts at murder, and woundings without number have been my own and my brother judge's fare for the last four weeks on one circuit, and in almost every case drink was the cause.

But, in addition to all this, the children of these unfortunates suffer just as the children of Bum and Tipsy suffered.

Professor Demme, of Stuttgart, studied the history of ten families of drunkards and ten temperance families for ten years, and then printed the results. He took notes about those human children just as carefully as Dr. Hodge took notes about the puppies.

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The following is a table which shows some of the things he learned about them.

	Drunkards' Families	Temperance Families
Number of children	57	61
Died before six weeks old	25	5
Idiots	6	0
Stunted in growth	5	0
Epilepsy	5	0
Nervous in childhood, but cured	0	6
Ordinary good health in childhood	17.5%	81.5%

Study these two columns carefully, and notice the number of idiots. Massachusetts tried to account for the number of idiots in the state and appointed a committee of investigation with Dr. Howe as chairman. He looked up the history of three hundred of these unfortunate children, and found that one hundred and forty-five of them had intemperate fathers and mothers.

Evidently children are apt to suffer quite as much as their parents in this matter. The truth is that the scientific facts about the effects of alcohol are not understood widely enough. No intelligent person will risk his health if he knows he is risking it. Definite study, therefore, in this direction is so important that in England, in 1905, fifteen thousand doctors signed a petition asking their government to teach the facts about alcohol to English school children as they are taught in America.

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CHAPTER XXVII

LITTLE TURTLE, ABRAHAM LINCOLN, AND THE LINCOLN LEGION

One hundred years ago Little Turtle was a famous Indian chief and warrior. He was also one of the Indians who signed the treaty of Greenville in 1795. And this treaty was supposed to join the red men to the white men in a peaceful bond.

No doubt the white settlers of the country were anxious to help their Indian fellow-countrymen, for in 1801 the Committee on Indians invited Little Turtle to go to Baltimore and tell them how they could be most useful to him and to his people. Now since the man was a full-blooded Indian and a fighter, and since he was spokesman for his fellow red men, who were also fighters and hunters, perhaps the committee expected him to ask for guns and powder, for blankets, beads, and tobacco. If so, his speech must have made them hold their breath and look at each other with surprise; for, instead, he begged them to save his people from the curse of the white man's alcohol. He spoke in the Indian language and every sentence had to be translated. Yet the meaning was plain and every one listened as he spoke.

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Brothers and friends, it is this liquor that causes our young men to go without clothes, our women and children to go without anything to eat, and sorry am I to mention to you, brothers, that the evil is increasing every day. Brothers, when our young men have been out hunting, and are returning home loaded with skins and furs, on their way if they come along where some of this whisky is deposited, the white man who sells it tells them to take a little and drink. Some will then say, "No, I do not want it." They go until they come to another house, where they find more of the same kind of drink. It is there again offered. They refuse again the second time, but finally, the fourth or fifth time, one accepts it and takes a drink, and, getting one, he wants another, and then a third and fourth, till his senses have left him. After his reason comes back again to him he gets up and finds where he is. He asks for his peltry. The answer is, "You have drunk them." "Where is my gun?" "It is gone." "Where is my blanket?" "It is gone." "Where is my shirt?" "You have sold it for whisky." Now, brothers, figure to yourself what a condition this man must be in; he has a family at home, a wife and children that stand in need of the profits of his hunting.

This, brothers, I can assure you is a fact that often happens amongst us. As I have before observed, we have no means to prevent it. . . . It is not an evil, brothers, of our own making; we have not placed it among ourselves. It is an evil placed amongst us by the white people; we look up to them to remove it out of our country. Our repeated entreaties to those who brought this evil amongst us, we find, have not the desired effect. We tell them, brothers, to fetch us useful things, bring goods that will clothe our women and children, and not this evil liquor that destroys our reason, that destroys our health, that destroys our lives. But all we can say on this subject is of no service, nor gives relief to your red brethren. Our young men say: "We had better be at war with the white people. This liquor they introduce into our country

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is more to be feared than the gun and tomahawk; there are more of us dead since the treaty of Greenville than we lost by the six years' war before. It is all owing to the introduction of this liquor amongst us."

Brothers and friends, since the introduction amongst us of what you call spirituous liquors, and what we think may justly be called poison, our numbers have greatly diminished. It has destroyed a great part of your red brethren.

These are a few sentences from the red man's great temperance address, and the committee who listened were so much impressed by it that they sent a copy to Congress and asked the senators to grant Little Turtle's petition. The government printed the speech, and to-day it is stored away in the Congressional Library in Washington.

No doubt it influenced the government at the time and helped the Indian; for after that, when the United States made treaties with the Five Civilized Tribes, they pledged the Indian that no white man should be allowed to sell intoxicating liquor in Indian Territory. And when, years later, the Indian tribes finally agreed to give up their own government and allow white men to live with them as citizens of Indian Territory, the one condition that they insisted on was that liquor should not come in at the same time. They were so earnest about it that our government gave them the following promise.

The United States agrees to maintain strict laws in the territory of said nation against the introduction, sale, barter, or giving away of liquors and intoxicants of any kind or quality.

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But Indians were not the only ones who were bright enough to try to save themselves from alcohol years ago. Abraham Lincoln lived and talked fifty years later, but he was just as much in earnest as Little Turtle, and he influenced small boys as well as statesmen.

Mr. Cleopas Breckenridge, of Springfield, Illinois, was a boy at that time. He says that one day in 1846 there was to be a temperance meeting near the new South Fork schoolhouse, not far from his home. The speaker was a vigorous young lawyer from Springfield, and for miles around the people wanted to hear him. So those who had horses and wagons hitched them up for service. They walked or they drove, according as they were able; and when they reached the appointed place they sat around on logs and boughs left over from the building of the schoolhouse, and listened to what the young man had to say. Evidently he was desperately in earnest, for he did not once suggest that they should be careful not to drink too much when they used liquor. Instead, he told them that the only safe way was to stop off short, to sign the pledge, and never to drink again.

He was such a good lawyer that he convinced his hearers with sound arguments. They agreed with him, and when he had finished speaking he said, "I have here a pledge which I have written and signed myself, and am asking my neighbors, so far as they are willing to do so, to sign it with me." Naturally enough, since

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they were already convinced, many in the audience were glad to sign it.

Mr. Breckenridge was a small boy at the time, but he remembers the day perfectly, and he says:

The first thing I knew the speaker was standing right in front of me. As I looked up into his face he said, "Sonny, don't you want your name on this pledge?" I answered, "Yes, sir." He said, "You know what it means — that you are not to drink intoxicating liquor as a beverage?" I answered, "Yes, sir, I know what it means." He then signed my name upon the pledge, knowing that a boy of my age in those days could not write his own name. And then, reaching down, he laid his hand upon my head and said, "Now, sonny, you keep that pledge, and it will be the best act of your life."

Here is the pledge as Abraham Lincoln wrote it.

Whereas, the use of alcoholic liquors as a beverage is productive of pauperism, degradation and crime, and believing it is our duty to discourage that which produces more evil than good, we therefore pledge ourselves to abstain from the use of intoxicating liquors as a beverage.

As Abraham Lincoln grew older, and while he was President of the United States, he was still true to what he believed, and he was always brave enough to say what he thought. He said:

Good citizenship demands and requires that what is right should not only be made known but be made prevalent; that what is evil should not only be detected and defeated, but destroyed. The saloon has proved itself to be the greatest foe, the most blighting curse, of our modern civilization, and this is the reason why I am a practical prohibitionist.

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With such a record as this it is not strange that to-day Lincoln is chosen as the great leader of the Lincoln Legion. The pledge they use is the pledge he wrote; and with his pledge to give them courage, and his name to inspire them, no wonder the first small legion has already become legions and legions strong.

It was started in Oberlin, Ohio, on the 21st of October, 1903, and it seemed to pick up the temperance subject where Lincoln left it off in 1846; for Cleopas Breckenridge and Moses Martin, his friend, had come from the schoolhouse meeting to this one. To be sure, fifty-seven years had slipped in between the two meetings, and these gray-haired men who came to town now were ten-year-old boys when they listened to Abraham Lincoln at the log schoolhouse. Still they had kept his pledge faithfully, and now they recited it again; and when it was written down and passed around for names they were allowed to sign it first, which made them the first members of the Lincoln Legion.

From that day to this Lincoln's name has seemed to act like a magnet, for the numbers ran up fast from tens to hundreds, from hundreds to thousands, in all parts of the country, until, during one year, two hundred and twenty-five thousand people joined the Legion and signed the pledge.

The plan is to put these Lincolnites into groups of tens, hundreds, and thousands. A comrade, as he is

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called, guides each ten, while each hundred and each thousand has a captain. There are secretaries for each state and each county, and the officers receive handsome papers which explain their commission.

The work of the Legion is very plain. It simply carries on what Abraham Lincoln began, and proposes to save as much of the country as possible from alcohol. To help the cause along each legion is supposed to hold its annual meeting on Lincoln's birthday, — an honorable memorial of him.

Another proposition is to turn our Fourth of July from a day of great carousing into the sort of patriotic, enthusiastic, anti-alcohol day that President Lincoln would have liked best.

Lincoln's own Legion, in 1846, met near a schoolhouse; the next one, in 1903, met in a college town; and to-day it is the intelligent school children all over the country that are asked to join the Lincoln Legions of our towns and our cities.

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CHAPTER XXVIII

WHY MOSQUITOES SHOULD GO

There is so much malaria on the Roman Campagna that during part of each year the business of having it really seems to be the occupation of the people. This is not strange, for to this day most of the inhabitants fail to protect themselves from it. They believe that malaria is a queer mixture of dampness and warmth; that it oozes out of the ground; that it belongs to certain places, as cold belongs to the north pole and heat to the torrid zone; and that no one who breathes it can escape it.

In 1900 two scientific men went to that region to prove an opposite doctrine which a few other scientists already believed. They chose the most malarial spot in the entire Campagna, and there they built a five-room cottage. It stood on the bank of a canal that swarmed with mosquito wigglers or larvæ, but every door and window of the cottage was closely screened to keep the mosquitoes out.

These facts are the ones to notice, for they are the very center of the experiment. When sundown came the men slipped into the cottage behind the screens, lit their

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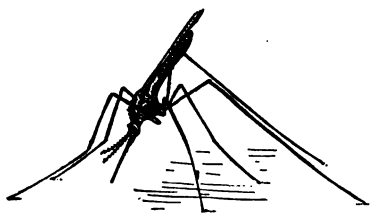
lamps, and watched the gathering of the anopheles mosquitoes on the outside. This is the kind of mosquito that lives in malarial places, and it seems that they generally stay in hiding by day. After dark, however, they stream out in swarms and start off on splendid hunting expeditions.



ANOPHELES POINTED FOR BLOOD

Three times as large as life. Malaria may follow

So now they came to the cottage, perched on the screens, and peered through with hungry eyes. They longed for one square meal of human blood, but the men did not relent. They simply went off to bed and left them there lamenting. It was easy to tell which the anopheles were, for, in standing, the end of the body generally points upward and away from the surface on which they stand, while the legs do not curl upward, although they sometimes stretch straight out behind. With the culex, however, — the mosquito that sings and stings harmlessly in every land, — the end of the body points downward when he stands, and his legs curl upward.

CURVED-LEGGED CULEX

Three times as large as life

When the malarial season of summer and fall was over the two men had escaped both anopheles and

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malaria. They had left their windows wide open, and had breathed the air of that malarial region every day and every night; yet they were as well at the end as at the beginning of their experiment. The news about it was telegraphed to all corners of the earth, and scientific men in every land knew at once that henceforward anopheles mosquitoes and human beings must stop living in the same houses.

Soon after came another experiment proving the case from the opposite side of the question.

Several anopheles in Rome were allowed to have a glorious feast on the blood of a man who had malaria. They were then shipped off to London, where a courageous man offered his body for the experiment. He had never had malaria; had never even lived in a malarial country, and the question was whether those Roman anopheles could actually bring the disease from Italy and prick it into a Londoner.

They were hungry when they arrived, took hold in earnest, and sucked all the blood they wanted. After that, sure enough, came the proof. The man became ill with malaria.

Microscopes have been used so faithfully since those days that scientists now know precisely how it is that anopheles can both rob a man of his blood and give him malaria at the same time. The mystery is with the microbe that spends part of its life in the stomach of

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the anopheles and the rest of it in the blood of man. It grows in both places, and would actually amount to nothing if it had to spend all its life in either place without going to the other.

Curiously enough, these malaria microbes are so fastidious that the body of no other kind of mosquito pleases them. They must live in the anopheles or nowhere.

More than that, the female alone gets the microbe, for she alone has a beak strong enough to puncture the human skin. As she draws blood from the little wound she has made, it always happens that, quite without any thought of harm, she lets some of her saliva drip into it, and just there are the microbes. They now dart into the red corpuscles of the blood, live there and grow large, divide into several parts, and end by bursting numberless corpuscles into fragments. When this happens the body that owns those corpuscles has a chill, and the doctor says: "Poor man! he has caught malaria somehow; we 'll have to dose him with quinine." It appears that quinine is sure to kill these special microbes.

After the new microbes have broken through the first red corpuscles they take up lodgings in others. At this point, therefore, the fever is well under way. Any anopheles mosquitoes sucking blood now will take malarial microbes into their stomachs with the blood

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and will pass them on to the next man they bite. From this history five things are clear:

1. Malaria is carried by the anopheles mosquitoes.

2. Anopheles carry no disease until they have sucked malarial blood.

3. No other kind of mosquito carries the disease.

4. If anopheles were banished from the earth, there would never be another case of malaria.

5. Until mosquitoes of every sort are banished, men must be protected from them.

Unfortunately for the harmless culex, he and the harmful anopheles multiply in the same ponds, visit the same houses, sing the same song, — though the anopheles has a lower voice, — and puncture the same men. They must therefore be killed or banished together, for there is no separating the one kind from the other.

Still another mosquito is yet more cruel than the anopheles. His name is stegomyia, and for many generations in Havana, Cuba, he carried on his terrible traffic in yellow fever without raising a suspicion.

This fever was as common in Havana as malaria is in Rome. It was also deadly and swift in the way it worked, and, from doctors down to children, every one

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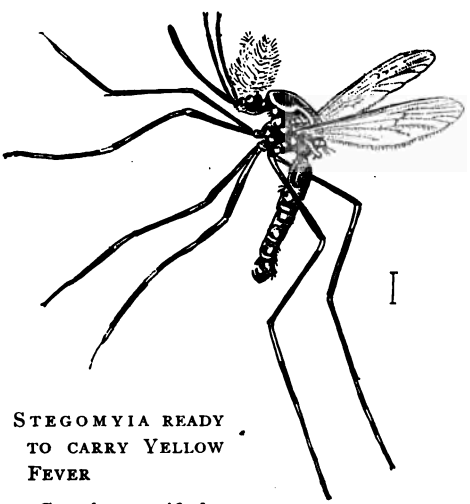
counted it contagious. They treated it as smallpox is treated; that is, healthy people fled from it, while those who had to stay dared touch nothing that belonged to a victim of it.

In those days, when Havana suffered most, every city in America that received fruit and merchandise from Cuba had a panic lest the fever should arrive with the cargo.

Now, however, there is a change.

Some one noticed that yellow fever and mosquitoes seemed to come and go together, even as mosquitoes and malaria go hand in hand. Later certain scientific men became so sure of this that they dared to undertake a famous experiment.



STEGOMYIA READY TO CARRY YELLOW FEVER

Greatly magnified

At Camp Lazear, one mile from the town of Quemados, Cuba, they built a small frame house, and for sixty-three days seven men took turns living there. They occupied the place two at a time, each couple staying about twenty days on a stretch. Here, as on

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the Roman Campagna, the house was so thoroughly screened that no mosquitoes, however slim or sly, could by any chance squeeze in.

Do not for a moment forget that at that time — the summer of 1900 — all the world was sure that yellow fever was carried from man to man in the clothing and the belongings of those who had the fever during the time that they used the things.

Now hear what the men did. They went into their small cottage; kept the mosquitoes out, to be sure, but received instead great boxes of bedding and clothing that had been used by yellow-fever victims. Soiled blankets and sheets, soiled pillow slips and night clothes, — things that different men had lived in for days, had slept in for nights, had even died in, — all these came to the camp without fumigation. The men there, however, put on the night clothes and slept in the bedding every night for weeks together.

Nevertheless, when the sixty-three days were over not a man of the number had caught the fever; they were as well as when they entered the cottage, and they had proved that yellow fever is not contagious, — that is, that it does not travel with the things the victims touch and use.

At the same time that this experiment was going on, another small building was put up at the camp. Here were two rooms with a wire screen dividing them.

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Everything that came to this house was most carefully disinfected by steam before it was received, and nothing but the cleanest, safest bedding was allowed. Seven healthy men entered the larger room, and stegomyia mosquitoes that had already drawn yellow-fever blood were turned into it, too. The men were truly brave, for, although they believed that stegomyia carried the fever, they were willing to risk their lives for the sake of learning how to save the lives of others.

After entering the room they were promptly bitten, for the mosquitoes were hungry. Then, as had been expected, yellow fever followed. Six men were ill with it, and one hero died. He was a surgeon in the United States Army, and the camp bears his name,— Lazear.

In the second room there were men but no mosquitoes; neither was there any yellow fever. The case was now as clear as possible against the unfortunate stegomyia, and Havana set to work to get rid of them.

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CHAPTER XXIX

WHAT NEW ORLEANS AND BROOKLINE DID

Five years later, after Havana had practically banished the mosquitoes and conquered the disease, behold, it broke out in New Orleans.

No one knew how it came, but it may be that mosquitoes loaded with yellow-fever blood stole a passage in some cargo from Central America and arrived in New Orleans as hungry as those Italian anopheles were when they reached London.

However that may be, early in the summer of 1905 the fever was in the city, and here and there men, women, and children were dying from it. Since mosquitoes abound in New Orleans, scientists knew at once that it was the old story over again:

1. A healthy man stabbed by a mosquito filled with yellow-fever poison.

2. A man with yellow fever and a mosquito that sucked his blood.

The more cases there were the more chances the stegomyia had, and by the 30th of July 260 citizens had yellow fever and 55 of them had died. By the middle of September 2462 citizens had had it and 329 of them were dead.

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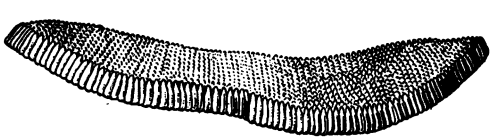
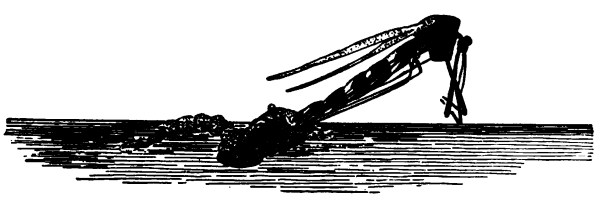
Yellow fever has often traveled even faster than that. In Philadelphia, for example, in 1798, over three thousand citizens died of it, while New York had over two thousand deaths during the same year from it alone.



CULEX EGGS
Magnified

TWO EGGS
Greatly magnified

In 1905, however, the epidemic in New Orleans gradually faded out after September. The truth is that intelligent people knew how Havana had saved herself, and they proposed to follow her example. Mosquitoes



FROM PUPA TO MOSQUITO (ANOPHELES)
Three times as large as life

were therefore slain by the million, and larvæ by the billion and the trillion. Everybody was in earnest. Ministers preached sermons on the subject; newspapers told the people what to do and begged them to do it; handbills and posters were put up here, there, and

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everywhere, urging all good citizens to carry on a valiant war; and at last there was such enthusiasm that rich men and poor men, young men and old men, women and children, all joined hands.

They worked Sundays as well as week days, for they knew that the choice lay between killing stegomyia or being killed by them.

Sulphur was used by the ton and kerosene oil by the tankful and the car load. Citizens work well in such a cause when they are intelligent, and even the children of the city now knew many of the following facts about stegomyia:

1. Mosquitoes lay two or three hundred eggs at a time in any spot, large or small, that holds water. A wide-spreading marsh is not too large, and a sardine can on a dump heap is not too small.

2. The more uncovered, standing water there is in a house or out of it the more mosquitoes there will be.

3. If there is no such water, there will be no mosquitoes.

4. Eggs turn to larvæ, larvæ to pupæ, and pupæ to mosquitoes.

5. It takes anywhere from ten days to a month for an egg to turn into a mosquito ready to bite.

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6. These mosquitoes do not often fly farther than three hundred yards from where they are hatched. But spots of standing water between cities make it possible for mosquitoes to reach widely separated places.

7. Larvæ breathe through a tube that runs off from the body near the tail. They thrust this tube to the surface of the water and draw air down through it.

8. If oil is poured on the water, each separate larva runs his tube into it. He is then drowned because the oil shuts him off from the air he needs to breathe.

9. All mosquitoes in houses should be killed.

10. No mosquitoes should ever be allowed to bite a yellow-fever patient.

11. No person should allow himself to be bitten by any mosquito of any sort, for it may turn out to be anopheles or stegomyia.

Knowing these facts, the citizens of New Orleans worked intelligently and with a will. In a single day fifty tons of sulphur were burned in houses and hotels to kill full-grown mosquitoes, while multitudes of young citizens fell to cutting grass and pulling weeds. They were determined to find every hidden pool and marsh, for there, they knew, were the eggs and the wigglers.

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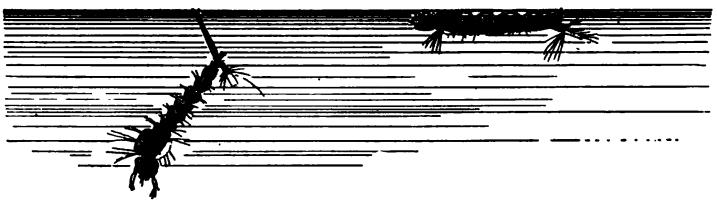
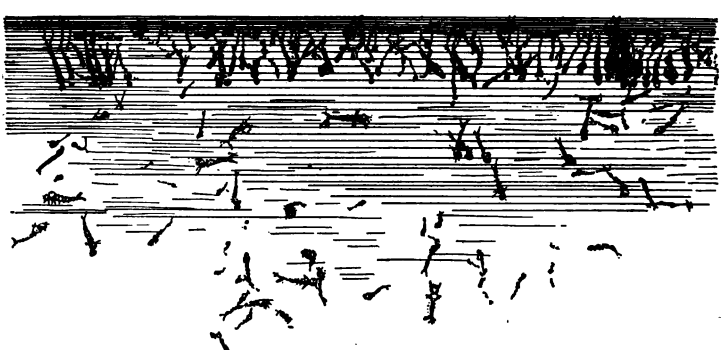
Other citizens drove carts loaded with earth and filled ponds and marshy places as fast as they were found. At the same time, on every street, there was a



CULEX WIGGLER ANOPHELES WIGGLER

Three times as large as life

smell of kerosene oil, for there were forty-five thousand open cisterns in the city and each one was being oiled.



WIGGLERS SWIMMING AND BREATHING

Life size

If New Orleans had given heed to what was done in Havana in 1901, she would have had no yellow-fever death record in 1905. She would have dislodged her

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mosquitoes in time to save her citizens. Wise cities all over the country are already doing this faithfully.

New York began her special mosquito work in 1902. She appointed inspectors to hunt for ponds, pools, and stagnant water; she asked every doctor to report all his malaria cases promptly, and offered to examine with the microscope, free of charge, the blood of any citizen who was supposed to have the fever. If, then, malarial microbes were found, it was plain that the man had the fever; if they were not found, the disease was evidently something else.

Brookline, Massachusetts, has fought the mosquitoes every summer since 1901. She has done this for three reasons:

1. There was malaria in the place.
2. Mosquitoes were a torment in the summer.
3. In certain parts of the town the value of property was low because the number of mosquitoes was high.

Even in 1901 the citizens knew precisely what should be done, and in 1901 and 1902 they took the following steps:

1. They made a list of the places where stagnant water stood.
2. They marked each spot on a map of the town.

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3. They asked a scientist to investigate each spot, and find out whether wigglers were in it, or whether frogs and fish were there instead.

It seems that, as a rule, frogs and fish enjoy wigglers so well that they help the town by eating them up. In most of the ponds and ditches, however, frogs were few and wigglers were many. These latter, therefore, needed vigorous treatment.

OILING A BROOKLINE POND TO SUFFOCATE THE WIGGLERS

The board of health now bought oil cans, picks, hoes, rakes, shovels, scythes, hand force pumps, watering pots, rubber hose, iron pails, and, most important of all, five hundred gallons of kerosene oil, the kind known as light fuel oil. This is thin enough to spread quickly and thick enough not to evaporate too fast.

To take charge of these things and use them the board next hired two laborers, a horse, a wagon, and an overseer, and sent them off to fill the small ponds and oil the large ones of the town. Watering pots and hose sprinkled the oil, though often all that was needed was to pour it on and stir up the water and let the oil do its own spreading.

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Still, even before that, work was necessary, for when either pool, pond, or ditch was overgrown with water weeds and grass, a scythe was first used to cut the stuff away. If the place was found to be shallow or small, instead of using oil it was filled with earth from some neighboring higher spot. To turn a pool into dry land in this way is a more permanent help than to oil it, for oil evaporates within two or three weeks and has to be put on again.

As the result of their labor, the citizens of Brookline succeeded in greatly reducing the mosquito nuisance. The fact, however, is that so long as neighboring cities do nothing in the matter, those towns that wish to protect themselves will have to renew the fight every year. This is necessary because mosquitoes are ready to lay their eggs in any pond or pool within their reach, and such places exist from point to point between most cities. Moreover, as we know, eggs in these ponds soon produce wigglers, while wigglers are soon full-fledged mosquitoes with wings and stings ready to suck blood from their human prey. To save themselves, therefore, groups of towns and cities must act together if they wish to rid themselves permanently of their common foe, the mosquito.

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CHAPTER XXX

HOSPITAL, DISPENSARY, AND AMBULANCE

When Mr. Barber, the traveler, visited China, taking notes of what he saw, he realized that the inhabitants of the Yunnan valley had never heard of microbes.

They did believe, however, that a certain deadly disease called the plague was contagious, and to save themselves from it those who were well never tarried for a moment near a victim of the disease if they could help it. They simply put the unfortunate person into a room by himself, placed a vessel of water by his side, left the room, fastened the door, put a long pole beside it, and went away.

Twice a day after that those same anxious relatives and friends returned to the door, opened it a crack, took hold of the long pole, thrust it into the room, and poked the man with it to find out whether he was still alive or whether he had died. Generally, of course, he died, but sometimes he actually recovered and staggered out of the room weak and forlorn enough, though ready to go on living for a while longer.

Still, even this strange treatment was wiser than that practiced by the Ponapeans when smallpox raged on their

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island, for the Chinese method does at least check an epidemic, while the Ponapean method advances it by leaps and bounds.

In all countries, however, hospitals are best. They existed long before Pasteur discovered the secret of epidemic microbes, but as no one in those days knew the tricks of the microbe, every sort of disease except smallpox was bunched together under the same roof. Consumption, scarlet fever, diphtheria, measles, and whooping cough sometimes flourished side by side, while in such a place children recovering from one disease were often weak enough and unfortunate enough to take another from some near neighbor.

This was the case in New York even as late as 1905. At that time, although every one knew whooping cough to be contagious, no whooping-cough hospitals had been provided in the city. When, therefore, a certain boy had the malady, and when, in spite of all he could do, he exposed many other children to it, the health department advised his going to a hospital.

Nevertheless, no hospital in New York was willing to expose its patients to the danger of catching the disease. The whole affair, therefore, ended by the boy's being sent to a particular hospital in another city where many different kinds of disease were cared for. As no other spot in the building was vacant, the officers put the boy in the scarlet-fever room, hoping, of course, that he

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would escape the disease. Instead, he added scarlet fever to whooping cough and died soon afterwards.

Fortunately that sort of thing is exceedingly rare in America; for in our largest cities each special disease has its own special hospital, or its special rooms apart from all the others.

An interesting example of this is in St. Paul, Minnesota. In that city the hospital that has special contagious-disease wards claims to keep two objects always in mind:

1. To quarantine contagious disease; that is, to keep each kind by itself.

2. To keep healthy people from being exposed to the contagious diseases that have come to the hospital to be cured.

Naturally, of course, everything is arranged to accomplish these two things.

The three-story red brick building stands on a high bluff surrounded by air and sunshine. It overlooks the Mississippi River, and from basement to roof it is a compact set of rooms constructed to keep the microbes of one disease from mingling with the microbes of the other diseases in the hospital.

To run no risk in the matter, each separate floor has its separate elevator, and the only way to go from floor to floor to the contagious-disease rooms is by stepping out of doors, using some outside stairs, and then stepping

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indoors again a story higher or a story lower, for there are no inside stairways connecting the stories with each other.

By all this arrangement the one hundred and fifty patients in the hospital are as safe from each other's diseases as if their different microbes lived in different buildings. That, indeed, is the ambition of every contagious-disease hospital in the world. They aim to be places where citizens have the best chance to overcome their own disease microbes and the least chance to share them with other people.

Small cities and large cities are alike in this, but each has its own special hospital history.

New York began with hers in the days when her city name was New Amsterdam. At that time the churches of the town raised money to care for the sick and unfortunate people of the place. Later the town itself helped pay the bills. Later yet, when a smallpox epidemic raged in 1736, the city built a small house on the spot where the city hall now stands, and called it the city poorhouse.

It was in that very building, one hundred and seventy years ago, that the great Bellevue Hospital began its history, for one room of this poorhouse was set aside for the use of citizens who had no other place to go, and who were too ill to care for themselves.

The room held six beds. It was not very comfortable, not very clean, not well ventilated, and no tidy trained

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nurse ever cared for the sick who were in it. Nevertheless, that was the hospital part of the poorhouse, and it was much better than nothing.

In those days, however, yellow fever visited the city almost every year. More beds were needed, also larger rooms, so another building was put up. After that still

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THE BELLEVUE HOSPITAL

another was required, and in 1811 the whole institution of poorhouse and hospital was moved to where the Bellevue Hospital stands to-day, though the name itself was not given to the place until 1825.

In the meantime, however, it continued to grow and has kept on growing ever since, constantly changing its character.

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Starting as a poorhouse, it became a hospital. Starting with one room, six beds, and small expense, it had in 1902, nine hundred and thirty-nine beds, with thirty thousand people cared for during one year, at an expense to the city, of four hundred and twenty thousand dollars. Opening for sick citizens who had almost every sort of disease, it now refuses to receive any citizen suffering with a contagious disease.

A Nurse
Ready to be useful

In other words, the hospital has grown with the city, while at the same time it has learned the lesson of the microbe and the danger of epidemic diseases.

During the years that the Bellevue was growing other hospitals also came to life, until to-day New York City has twenty-two of them. Some are supported by the city, others by generous citizens. Some take care of all diseases save those that are contagious; others are for

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contagious diseases alone, — for measles, consumption, diphtheria, smallpox, cancer, and the like. Others yet are for special sets of people, as for children and the aged; also for special diseases of special parts of the body, — for example, the eye and ear, the nose, throat, and skin.

As interesting as any is the wonderful children's hospital on Forty-second Street. Here two hundred children with crooked bones and twisted backs are gradually being made straight again. Their disease is really tuberculosis of the bones, yet in the midst of sunshine, pure air, and cleanliness, with toys to keep them merry and kind nursing to help them along, case after case improves and even gets well again.

In every hospital, in every land, the same laws of cleanliness and sunshine, of good nursing and skilled doctors are the laws of quick recovery. Still some hospitals have more money with which to carry out the laws, while others are more modern and can do it better.

St. Luke's Hospital, in New York, seems to be a model in all directions, as the following precise facts will show:

1. Its location is Morningside Heights, the most beautiful hospital site in New York City.

2. The building is gray brick and stone on the outside; on the inside exceedingly plain, no chance for dust anywhere, no sharp angles where floor meets wall or where wall meets ceiling, curves being used instead. No

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moldings are on the walls to hold dust, and there are no curtains or carpets in the rooms to catch and keep it.

3. Each ward shows polished floors, white walls, white iron bedsteads, and long rows of windows, while cleanliness, sunshine, and good cheer are on every side.

4. There is perfect ventilation. In each room the air is changed every ten minutes, while at the same time it is kept warm in winter and cool in summer.

This hospital provides for three hundred free patients, beside thirty-six others who pay for what they get. It receives its patients from doctors all over the city, and supplies ten house doctors, seventy-one nurses, and one hundred and twenty-five servants to attend to their wants.

Last of all, and one of the most important things that hospitals provide for citizens, is the ambulance. Listen to the clanging bell, and see wagons, horses, and men move quickly aside as one of the long black wagons rushes by.

Some doctor or policeman has called it by telephone, and even the horses seem to understand that a citizen is injured, ill, or dying; that a human life is at stake and that the ambulance must reach him in time. In fact, according to city law, everything else gives way as promptly to an

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ambulance as to the fire engine; while safely stowed away inside are bandages, medicine, and instruments, and a surgeon ready to use them on the way to the hospital if they are needed.

New York City has thousands of these vehicles. Each belongs to its own particular district, serves its own

TO CARRY THOSE WHO SUFFER

particular hospital, and is ready to start at a minute's notice.

Dispensaries also have their own districts. There are several times as many dispensaries as hospitals in New York City, and indeed there should be, for they give free medicines and free advice to citizens who are not ill enough to go to bed, whereas the hospitals are only for those who are ill enough to spend most of their time lying down.

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QUESTIONS

Chapter I

What advantage has a city man over an Indian on the prairie? Mention some ways in which city people help each other. Describe the growth of New York from 1700 to 1900. What changes were made in houses and streets? What did the city do, with a hundred thousand fresh arrivals every year? What is an air shaft? Who suffer most in dark, unventilated rooms? Why do people crowd into certain parts of a city?

Chapter II

What happens to overcrowded halls, rooms, and houses? What state of things did Mr. Riis find in New York City? What three conditions are best for microbes and worst for men? What is the death rate in healthful cities? What increases the death rate? What are rear tenements? Why are they sometimes called "infant slaughter-houses"? What do statistics prove about one-room and four-room tenements? In what other way may crowded tenements be a source of danger to citizens? Give two reasons why every part of a city should be clean and well ventilated.

Chapter III

What is a tenement house? What city department takes charge of them in New York? How many inspectors were appointed in 1902? Describe the work of one of them. What three things did the department

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plan to do? Describe an "old-law" tenement; a "new-law" tenement. How did citizens show delight over the new houses? What was done to old tenements? What was the New York death rate in 1866? in 1903? When the death rate in New York in one year is seventeen instead of eighteen per thousand, how many lives are saved?

Chapter IV

How did Massachusetts study the connection between crime and alcohol in 1880? Give the number of alcohol arrests; of all other arrests. What was the record for twenty years before that? In 1900 what share of the Elmira convicts had drunken ancestors? How did those ancestors increase the expenses of the state of New York? How do sober people pay the drunkard's bills? How is the money raised? Describe the wave of temperance in Ireland. Mention some differences between Vineland and New Britain in 1893. What things are people glad to be taxed for?

Chapter V

What difference is there in the air of different streets? What advantage have tall people over short people in the matter of street air? Who cleaned the streets of New York City in 1898? What was their condition? What did Colonel Waring decide about street sweepers and politics? What were the sweepers called? Why? Describe the division of the work. What was the result? Tell what is done with the snow in New York City after a storm.

Chapter VI

What did the juvenile leagues do? Tell about their reports. Give the civic pledge. Describe the parade in 1896. What effect did New York's example have on other cities?

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Chapter VII

Who is the head of the street-cleaning department in your city? What is the New York law about throwing things into the street? What should go into garbage receptacles? into ash cans? into rubbish bundles? Why are these kept apart? What was formerly done with all the waste material of New York City? Which part of it now goes to Riker's Island? Which part to Barren Island? Describe the treatment it gets. What becomes of rubbish bundles? How do they benefit Williamsburg Bridge? What three things does New York do with her waste?

Chapter VIII

Why are parks and playgrounds important? How did New York policemen help the park committee? What is the New York law about playgrounds and schoolhouses? Why are playgrounds put on the roof of school buildings? Tell what you can of Boston's parks. What is the usual charge for a public bath in the United States? Why do cities wish their citizens to bathe? Mention three important points about city baths. Why are tubs objectionable? What advantage has a shower bath? Mention some of the gymnastic apparatus in Seward Park.

Chapter IX

What apparatus does a fireman use? What must he learn to do? Where does he have the hardest work? Give two important fire laws for the new-law tenement houses. Tell all you can about fire escapes, — stating where they should be, and describing the difference between the right and the wrong kind. Why is there a law against encumbered fire escapes? What is the fine? What should you do in case of fire? Describe some school that saved itself by the fire drill. Mention some fires that are caused by carelessness.

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Chapter X

In former times what did railroad men do about using alcohol? What did other people think about those men? What change do we now find? Tell what you can of railroad changes within eighty years. Why are more careful railroad men needed now than in early days? What did railroad companies first notice about drinking and accidents? What rule did they make first? What other rules were made later? How do we know that the railroad business of the country is one of the largest, strongest, and strictest temperance societies in the world?

Chapter XI

What other great business does temperance work? What did people formerly think about alcohol and long life? What did a certain life insurance company do in 1840? How did that company make its discovery about total abstinence and long life? What was the discovery? What did other societies also find out? What difference does this sometimes make in paying for life insurance? When men train as athletes what is the rule about using alcohol?

Chapter XII

What did New York City do for water in early times? What did she finally do? What danger threatened in 1900? Tell what you can about Croton River, the dam, and the aqueduct in 1905. What has New York done about getting a larger supply of water? How does any city know how much to plan for? What did Massachusetts learn about the use of meters? Why does a city without meters waste more than a city with them?

Chapter XIII

What did the Romans do for drinking water? What two water lessons has China learned? What did the cholera records for London

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prove? Describe the epidemic for 1854. What was the cholera notice? Give the circle of the water history. How may pure rain water become impure? Which is the special water disease in the United States? How do typhoid microbes reach the water? Why do we need to know the history of surface water? When is drinking water perfectly safe?

Chapter XIV

Describe the epidemic in Plymouth, Pennsylvania. Where did the typhoid microbes come from? What did that one epidemic cost Plymouth? What three points must be kept in mind when men search for a water supply for a town? Give the history of Cleveland and her drinking water. What became of her sewage? Tell about the epidemic in 1903. What did Cleveland do? What difference did the new arrangement make in the typhoid death rate? What did Chicago do to improve the drinking water?

Chapter XV

Describe the growth of cities on the Merrimac River. What drinking water did they use? What became of their sewage? Which houses on the river were sure of pure drinking water? Even after they learned about microbes what did scientists still think about water that is in motion? What difference does it make whether a river carries much or little sewage? What city on the Merrimac had the most typhoid deaths? Which was farthest downstream? How far is Lawrence from Lowell? Give the experience of Newburyport in 1893. What connection did people finally notice between typhoid in Lowell and in Lawrence? Since Lawrence always had Lowell sewage in her drinking water, why did she not always have typhoid fever? What did the Massachusetts Board of Health do to help these cities?

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Chapter XVI

What did the Massachusetts Board of Health advise Lawrence to do? How were the filters made? Describe the water before it went into the filters and after it left them. After two years how did Lawrence know that her filters still worked well? In what way does the Board of Health help other cities? Besides advising sand filters for Lawrence, what else has the board done there? What has that experiment station learned about sewage? What is the difference between sand filters for water and for sewage? What becomes of the microbes in the water and sewage? What is the difference between a continuous filter and an intermittent filter?

Chapter XVII

In war, as a rule, how many soldiers in every hundred are killed by bullets and how many by microbes? Why did Japan need to change the record? What did she decide to do about preventable diseases? How did she go to work to save her soldiers? Tell all you can about it. What command was given on war ships before a battle? When the war was over what change had Japan made in the death record for bullets and microbes?

Chapter XVIII

Who was Professor Seaver? What did he wish to find out about tobacco? What records did he keep for nine years? What did these records show about the age of smokers and non-smokers who entered college? What difference was there in the height of the men? in the size of their lungs? Into what three groups did he divide the college students? Which group gained most in every direction? Which were the best scholars? Why did the Japanese government discuss the subject of tobacco? What arguments did the speakers use? What was the result of the great discussion?

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Chapter XIX

How did the Board of Health know that the Springfield epidemic in 1892 came from milk? Tell what you can about the New York babies and the milk they used in 1903. What did the health department wish to learn? What is pasteurized milk? What is the important difference between raw milk and pasteurized milk? Which kind proved to be best for the babies? In what two ways may microbes damage milk? What does boiling do to microbes? What are the three important conditions of pure milk? What two points was the milk investigator to look into?

Chapter XX

Describe a model dairy. Describe one of the opposite kind. Why does not straining the milk take out the microbes? What three facts does a model dairy teach about microbes? What does a "microbe dairy" teach? Give some of the instructions that the New York health department send out in regard to milk. Besides watching the milk supply what else do city inspectors do? Describe the work done in Rochester, New York.

Chapter XXI

Who first discovered disease microbes? Describe the harm they were doing to silkworms. What four facts did Pasteur learn from his two sets of eggs? How did he get healthy worms to eat microbes? What was the result? As a rule, how did healthy worms catch the disease? Describe the hook discovery. What did Pasteur decide to be the only way to raise healthy worms? How do women and girls help in this matter in France? What four silkworm discoveries are more important to men than to worms?

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Chapter XXII

How did Pasteur raise his weak and his strong microbes? How did he use these microbes when he wished to save an animal from splenic fever? In what way did his discoveries save the lives of thousands of sheep and cows in France? How may hydrophobia be prevented? What do microbes make while they multiply? Is it the microbe or the toxin that does most harm in a case of diphtheria? What cures diphtheria? Which animals raise antitoxin for us? Tell as much as you can about the way in which it is done. What do we mean when we say a horse is immune? Why should antitoxin be used as promptly as possible after diphtheria begins?

Chapter XXIII

Why did Cleveland doctors hurry so with their vaccinating? What started the epidemic on Ponape? Describe it. What is the difference between inoculation and vaccination? What did New York City do to check a smallpox epidemic in 1902? What were some of the duties of the inspectors? How many citizens were vaccinated within six months? What led Dr. Jenner to his discovery? How is vaccine raised? How often should we be vaccinated?

Chapter XXIV

How many people died from tuberculosis in New York City in 1904? How many in the United States? Who discovered the tubercle bacilli? When? Give some facts about the microbe. In which parts of a city do we find the most consumption? Describe "Lung Block." How does one case of consumption in a room lead to others? Where do microbes stay? How do they reach the air? What objection is there to dry sweeping and a feather duster? How do microbes reach the lungs? Give their history after that. What do the lung cells try to do?

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Why is sputum dangerous? Do we inherit consumption? How may parents give consumption to children? Why is it important to know the history of the rooms we are to live in?

Chapter XXV

Give the triple motto used by those who fight tuberculosis. Mention two ways in which a city may save itself from tuberculosis. Tell what you can of the anti-tuberculosis work of New York City. In what way is tuberculosis like a fire in the lumber yard? Mention the four things which help cure consumption. How may people get fresh air even in a city? Tell what you can about tents and outdoor life for consumptives. What are the five tuberculosis D's? Give the golden rule of the anti-tuberculosis leagues.

Chapter XXVI

What experience did an American nurse have in Havana? In Professor Guttstadt's tuberculosis death-list which class of people stands highest? How can you explain this? What did Professor Adams learn about cholera? What did Dr. Thomas learn from the rabbits? Tell what you can about the remarks of the Toledo doctors. What does Dr. Atwater say about the effect of alcohol on the mental functions? Give what you can from Professor Demme's record of intemperate families and temperate families.

Chapter XXVII

Who was Little Turtle? What help did he ask of the white man? Repeat some of the things he said. What treaty did the United States make with the Five Civilized Tribes? What did Abraham Lincoln believe about alcohol? What did he advise people to do? Did he ever change his mind on the temperance question? When was the Lincoln Legion started? How fast did it grow? Give the Lincoln pledge. What does the Lincoln Legion do?

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Chapter XXVIII

In former times where did people think malaria came from? Why did those two men live on the Roman Campagna? Describe the house. How can we tell anopheles from culex mosquitoes? Which kind went from Rome to London laden with malarial blood? What was the result? How do the malaria microbes get from one person to another? What five points does the life of the microbe in man and mosquito prove? What special fever was common in Havana? Describe the experiments in Camp Lazear. What did the experiments prove?

Chapter XXIX

What happened in New Orleans in 1905? What did the citizens decide to do about it? Give all the facts you can about mosquitoes. Describe the mosquito war. What weapons were used? Who did the fighting? What was the result? Why did Brookline fight mosquitoes? How did she go to work? How did frogs and fish help? What has Brookline accomplished?

Chapter XXX

In China how did the natives formerly treat a man with the plague? What used to be the objection to our hospitals? What two special things does a contagious-disease hospital accomplish? Describe the hospital in St. Paul. Give the history of the Bellevue Hospital. In these days what special diseases have special hospitals? Describe St. Luke's Hospital. What is an ambulance? How is it furnished? What is the difference between a hospital and a dispensary?

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GLOSSARY

KEY TO PRONUNCIATION

a as in fāte, senāte, făt, ärm, ạll, ásk, whạt, câre.
e " mēte, ẻvent, mĕt, hēr, thêre, obẹy.
ee " fēēt.
i " īce, ĭdea, ĭt, sīr, machĭne.
o " ōld, ŏbey, nŏt, mọve, wọlf, sȯn, hôrse, wõrk.
oo " fo͝od, fo͝ot.
u " ūse, ŭnite, ŭp, fûr, rụle, pụll.
y " flȳ, mẏself, babў, mў̆rrh.
au " author.
aw " saw. ew as in new. oi as in boil.
oy " boy. ou " out. ow " cow.
c (unmarked) as in call; ç " mice.
ch (unmarked) " child; çh " chaise; ch (= k) " school.
g (unmarked) " go; ġ (= j) " cage.
ng as in ring. n̲ (= ng) " ink. ph (= f) " phantom.
s̲ (= z) " is. si (= sh) " tension; s̲i (= zh) " vision.
th (unmarked) as in thin; th " then. ti (= sh) " motion.
x (unmarked) " vex; x̲ (= gz) " exact.
Obscure sounds. ạ, ẹ, ị, etc. Silent letters are italicized.

ăl*m*s̲'h*ouse*, poorhouse.

ăm'bŭ lạn*ce*, a vehicle for the sick or injured.

ăn ŏph'ẹ lēs̲, mosquitoes that carry malaria.

ăn tĭ tŏx'ĭn, a substance which neutralizes the action of a toxin, or poison.

ăp pȧ rā'tŭs, a collection of tools or materials to accomplish some purpose.

ăq'uĕ dŭct, an artificial channel (k)(w) for conveying water.

ăth'lēt*e*, one trained to exercises of agility and strength.

bȧ çĭl'lŭs, a germ which is the cause of various diseases.

băc tē rĭ ŏl'ŏ ġĭst, one who makes a study of microbes.

bĭ ŏl'ŏ ġĭst, one who studies the science of life.

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brĭ gād*e*′, a name given to a large body of soldiers.

cȧm pä′gn ȧ, an open plain.

căm pā*ig*n′ (ny), continued operations for the accomplishment of some purpose.

căn′çẽr, a kind of tumor; a dangerous disease.

cär′bŏn dī ŏx′ĭd, carbonic acid, a gas.

çĕn′tĭ mē tẽr, the 100th part of a meter; or .3937 of an inch.

çẽr tĭf′ĭ cǡt*e*, a written declaration.

chĕm′ĭ ca̯l, belonging to the science of chemistry.

chŏl′ẽr ȧ, a dangerous epidemic disease.

chrў̆s′ ȧ lĭs, the form that many insects assume between the caterpillar and the winged stage; a cocoon.

cȱ cōōn′, a silken case made by some worms and insects to protect their eggs.

cŏm mĭs′siȯn, persons intrusted with some special duties.

cŏm mĭt′tē̇*e*, persons appointed to attend to any matter.

cŏn stĭ tū′tiȯn, a set of rules for the government of a society or state.

cŏn sŭmp′tiȯn, a disease of the lungs.

cŏn tā′ġ*io*ŭs, liable to spread from one to another.

cŏn tăm′ĭ nāt*e*, to soil; to corrupt.

côr′pŭs çl*e*, a small particle.

cŏr′rĭ dōr, a passage or gallery.

cū′lĕx, the common, harmless mosquito.

dăm′ǡġ ĕş, that which is paid to repair a loss.

dĕl ē̇ gā′tiȯn, persons selected to act for others.

dī′ȧ grăm, a mathematical figure or drawing.

dĭ ġĕst′ẽr, a strong, close vessel in which substances can be heated to a temperature above boiling.

dĭ lūt*e*′, to thin by mixing with something.

dĭph thē′rĭ ȧ, an infectious disease of the throat.

dĭs pĕn′sȧ rў̆, a place in which medicines are given to the poor.

ē lĕc trĭç′ĭ tў̆, a power in nature exhibited in lightning, the production of heat, light, etc.

ĕp ĭ dĕm′ĭc, affecting numbers of persons at the same time.

ē̇ văp′ȱ rāt*e*, to pass off in vapor.

ĕx pĕc′tȱ rāt*e*, to spit.

ĕx pō şĭ′tiȯn, a public exhibition or show.

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fạu'çĕt, a fixture for drawing liquid from a pipe or cask.

fēr'tĭl lī zēr, that which enriches or makes productive.

flăt, a series of rooms on one floor occupied by a single family.

flŭsh'ĭng, washing out; flooding drains or sewers to clean them.

fôr'ăġe, to search for food.

fū'mĭ gā'tiŏn, the act of applying smoke or fumes for various purposes.

gär'băġe, refuse; any worthless matter.

ġĕl'ā tĭn, a substance made by boiling bones and other animal substances. It is used in glue and as a jelly for food.

glāzed, to cover with a glossy surface.

ġўm nā'şĭ ŭm, a place for athletic exercises.

hĕad quạr'tērş, the place where a chief officer lives or carries on business.

hў drŏ phō'bĭ ā, a disease caused by the bite of a mad dog.

hў'ġĭ ēne, the science of the preservation of health.

ĭl lū'mĭ nāt ĭng, supplying with light.

ĭm mūne', exempt from disease.

ĭn çĭn'ēr ā tọr, a furnace for burning substances.

ĭn çĭ'şiŏn, a cut; a gash.

ĭn ŏc ū lā'tiŏn, the act of introducing a disease germ into the tissues for protection from a more severe form of the disease.

ĭn spĕc'tọr, one who oversees or examines.

ĭn tēr mĭt'tẹnt, stopping at intervals.

ĭn tĕs'tĭne, the lower part of what is called the alimentary canal.

ĭn tŏx'ĭ cạnt, that which intoxicates or makes drunk.

jū'vĕ nĭle, youthful.

lăb'ŏ rā tŏ rў, a place for operations and experiments.

lär'vā (plural, larvæ), an insect in the grub state.

lēague, persons united for some particular purpose.

lĕġ'ĭs lā tūre, a body of men invested with power to make laws.

līfe ĭn şụr'ạnçe, (sh) a contract by which a company for a sum of money agrees to pay to a man's heirs a certain amount in case of his death.

mā lā'rĭ ā, a disease carried by mosquitoes.

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mē'tẽr, an instrument for measuring the quantity of gas or water used.

mĕt rȯ pŏl'ĭ ta̯n, belonging to a large city.

mī'crōb*e*, a creature so small that it can only be seen through a miscroscope.

mī'crȯ scōp*e*, an instrument for examining objects too small for the naked eye.

mĭs dė mē*a*n'õr, ill behavior; fault.

n*e*ū'tra̯l īz*e*, to counteract; to destroy the effect of.

ŏx'ў ġĕn, the element of the air that supports life.

Pär'lĭ*a* me̯nt, the legislative assembly of Great Britain.

păs tē*u*r'īz*e*, to treat certain diseases, especially hydrophobia, by a method devised by a French scientist named Pasteur.

pȧ vĭl'i(y)ȯn, a tent; a movable habitation.

pĕn ĭ tĕn'tiȧ rў, a prison in which convicts are confined for punishment.

pŏl lūt*e*', to soil; to corrupt.

pȯ mā'tŭm, an ointment.

Pō'nä pe̯, one of the Caroline Islands.

prŏc lȧ mā'tiȯn, an official or general notice.

qua̯r'a̯n tïn*e*, the separation from others of persons or objects coming from a neighborhood where there is dangerous contagious disease.

rė çĕp'tȧ cl*e*, a place to receive things.

rĕf ŏr mā'tiȯn, amendment; correction.

rė fôrm'ȧ tȯ rў, a place for the reformation of young criminals.

rē lā*y*', those who relieve others by taking their places.

rĕs̯'ẽr voir (vwôr), a place where water is collected for use.

rė strĭc'tiȯn, limitation; restraint.

sănd fĭl'tẽr, layers of gravel, coarse and fine sand, through which water runs and is purified.

săn'ĭ tȧ rў, relating to the preservation of health.

s*c*ȳth*e*, an instrument for cutting hay or grain.

sĕn'te̯nç*e*, a decree or verdict of court.

sē'rŭm, the watery part of milk and blood.

sew'ȧġ*e*, matter carried off in drains or sewers.

sew'ẽr, a canal made to carry off waste water.

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sŏ lū'tiŏn, a preparation made by dissolving a solid in a liquid.

splĕn'ĭc, pertaining to the spleen.

spū'tŭm, that which is spit or raised from the lungs.

stá tĭs'tĭcs, a collection of facts relating to any people, industry, state, etc.

stĕg ŏ mȳ'ĭ a, a mosquito that carries yellow fever.

sûr'ġeŏn, one who performs manual operations on a patient.

tĕn'ĕ mẹnt, house in which three or more families live and keep house separately, or where more than two families live on one floor.

tŏx'ĭn, poison produced in the system.

tū'bēr cle, a small mass of diseased matter.

tŭ bēr cŭ lō'sĭs, a disease which, in the lungs, is commonly called consumption.

văc'çĭ nāte, to inoculate with virus from cows to prevent smallpox.

vŏl ŭn tēēr', one who enters a service of his own free will.

wĭg'glēr, the young of the mosquito.

yĕn, a Japanese coin.

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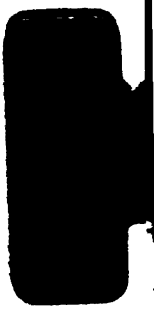

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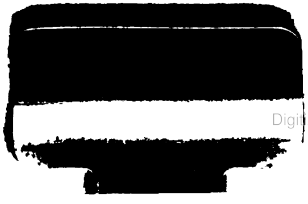

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